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Embedding Software Quality

Application Note

Debugging the TriCore TC1796

How to use the PCP

This documentation demonstrates how to use the PCP of the TriCore TC1796 and debug it with the Tanto debug system.

Architecture:	TriCore
Author:	Peter Walk (Hitex GmbH, T&I)
Revision:	08/2005 - 001

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Preface

In order to keep you up-to-date with the latest developments on our products, we provide Application Notes containing additional topics, special hints, examples and detailed procedures etc.

For more information on the current software and hardware revisions, as well as our update service, please contact www.hitex.de, www.hitex.co.uk or www.hitex.com.

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1 Introduction

This application note describes how to debug the TC1796 PCP. We are using HiTOP and the Tanto-TriCore to debug and DAvE and Tasking VX-Toolset for TriCore v2.2r1 to generate the application. The evaluation board being used is an Infineon TriBoard - TC1796.300.

The aim of this document is to debug a PCP example with HiTOP. For this, the following has to be performed:

- adjusting the TriCore peripherals using DAvE,
- creating an executable using the Tasking Tool chain,
- opening the debug session using the Tanto debugger and HiTOP as the user interface.

Note that an example project for the Tanto TriCore can be downloaded from www.hitex.com which will do the required settings.

2 About PCP

The PCP is a Peripheral Control Processor that relieves the CPU from most of time critical interrupts. Basically the PCP is to be considered as a conventional processor executing code in response to interrupts only. Whenever the PCP handles an interrupt, it will use a register set, which depends on the interrupt priority level currently used. For this reason the term "channel" will be used in this document.

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3 Example

To demonstrate the behavior of the PCP four different channels are used to handle four different interrupts from the TC1796.

The following table shows the assignment of the interrupt/channel to the function in the PCP program.

Channel / Priority level	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
Description	Toggles the on-board LED (Pin 1.15).	Toggles an LED externally connected (Pin 4.7 in this example).	Simple echo function at the serial port ASC0, storing the character into a global variable.	Increments a global variable.
Used port	Pin 1.15	Pin 4.7	ASC 0	-

Table 1 Example program functions

Channel / Priority level	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
Interrupt	GPTA0-SRN14	GPTA0- SRN10	ASC0 receive SRN	GPTA0-SRN6
Used timer array	GPTA0	GPTA0	-	GPTA0
Used timer cell	GTC16	GTC8	-	GTC0
time	1 sec	0.5 sec	-	1 sec

Table 2 Used timer / interrupts

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Toggle LED

The codes for channel 1 and channel 2 are identical, except for the port used. The first entry point from the channel is stored in the CSA. It is preselected with the address from the label "channel_1"/"channel_2". With the very first interrupt concerning the channel the port is initialized, and the port is set to low. The PCP runs to the exit command and waits for the next interrupt. From this point the PCP continues working from next PC to the next exit command and switches the LED on. With the next interrupt the PCP switches the LED off and runs until exit. The next interrupt causes the PCP to jump to the label "led_on". This behaviour is the same like with channel 2.

```
            ;-----------------------------------------
            ; Channel 1, toggle LED P1.15
            ;-----------------------------------------
channel_1:
            nop
            ldl.iu r1, @hi(P1 IOCR12)              ; Initialize port P1:
            ldl.il r1, @lo(P1 IOCR12)              ; port control register 12
            set.f [r1], 0xf, size=16               ; Set pin P1.15 to Output
            clr.f [r4], 0xf                        ; Set pin P1.15 to Low
            nop
            exit ec=0, st=0, int=0, ep=1, cc_uc    ; Exit, no interrupts, start @next PC
            nop
led on:                                            ; Swith LED on
            clr.f [r4], 0xf                        ; Clear P1.15
            nop
            exit ec=0, st=0, int=0, ep=1, cc_uc    ; Exit, no interrupt, start @ next PC
            nop
led off:                                           ; Switch LED off
            set.f [r4], 0xf                        ; Set P1.15
            nop
            exit ec=0, st=0, int=0, ep=1, cc uc    ; Exit, no interrupt, start @ next PC
            nop
            jl led_on                              ; Loop



;-----------------------------------------------;
;  .pcpdata'
;-----------------------------------------------;

ch1:
            .word (channel 1 << 16) | 0x0140       ; R7 DPTR 0x1, chan.enable
            .word 0x00010000                       ; R6 CPU Interrupt Configuration
            .word 0x0                              ; R5
            .word P1_OUT                           ; R4 P1 Output Register
            .word 0x0                              ; R3
            .word 0x0                              ; R2
            .word 0x0                              ; R1
            .word 0x0                              ; R0

ch2:
            .word (channel 2 << 16) | 0x0140       ; R7 DPTR 0x1, chan.enable
            .word 0x00010000                       ; R6 CPU Interrupt Configuration
            .word 0x0                              ; R5
            .word P4_OUT                           ; R4 P4 Output Register
            .word 0x0                              ; R3
            .word 0x0                              ; R2
            .word 0x0                              ; R1
            .word 0x0                              ; R0
```

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Local Echo

With each interrupt from the ASC0 the PCP loads the ASC0 receive buffer and transfers it into the ASC0 transmit buffer. Additionally, the transmit buffer will be copied into R3, that is the cBufPCP variable in the main program. After the next interrupt, the PCP jumps to the beginning of this code part and runs up to the exit command.

```
;-----------------------------------------
; Channel 3, local echo on ASC0, transfer
;            value to R3 -> global variable
;-----------------------------------------
channel_3:
            LD.F R1, [R4], SIZE=32                ; R1 = ASC0 Receive Buffer
            nop
            ST.F R1, [R5], SIZE=32                ; ASC0 Transmit Buffer = R1
            nop
            ST.F R1, [R3], SIZE=32                ; ASC0 Transmit Buffer -> R3 -> cBufPCP
            nop
            EXIT EC=0, ST=0, INT=0, EP=1, cc_UC   ; exit, no interrupt, start @ next PC
            nop
jl channel 3

;-----------------------------------------------;
;  .pcpdata'
;-----------------------------------------------;
ch3:        .word (channel 3 << 16) | 0x0140      ; R7 channel enable set, DPTR=0
            .word 0x01000000                      ; R6 CPU Interrupt Configuration
            .word ASC0 TBUF addr                  ; R5
            .word ASC0 RBUF addr                  ; R4
            .word cBufPCP                         ; R3
            .word 0x00000000                      ; R2
            .word 0x00000000                      ; R1
            .word 0x00000000                      ; R0
```

Increment

With the first interrupt concerning this channel the PCP loads the contents from the variable lGlobalCounterPCP into the register R1, increments it by 1 and then stores it back to the variable. After an interrupt the PCP jumps to the beginning of this section, repeats the procedure and halts on the "exit" command.

```
;-----------------------------------------
; Channel 4, increases R5 -> global variable
;-----------------------------------------
channel 4:
            LD.i R1, 0x1
            nop
            ADD.F R1, [R5], SIZE=32
            nop
            ST.F R1, [R5], SIZE=32
            nop
            EXIT EC=0, ST=0, INT=0, EP=1, cc_UC   ;exit, no interrupt, channel start @ next PC
            nop
            jl channel 4


ch4:        .word (channel 4 << 16) | 0x0140      ;R7 channel enable set, DPTR=0
            .word 0x01000000                      ;R6 CPPN=1
            .word lGlobalCounterPCP               ;R5
            .word 0x00000000                      ;R4
            .word 0x00000000                      ;R3
            .word 0x00000000                      ;R2
            .word 0x00000000                      ;R1
            .word 0x00000000                      ;R0
```

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3.1 Debug Session

In order to get a quick entry in debugging the PCP, a ready-to-start example is available from www.hitex.com. If you want to generate a project from scratch, you have to initialize the TriCore's SFRs and then generate an executable file. For more information on how to do this refer to p. 31ff.

In this section the first debug session using the Tanto debugger and the HiTOP user interface is described.

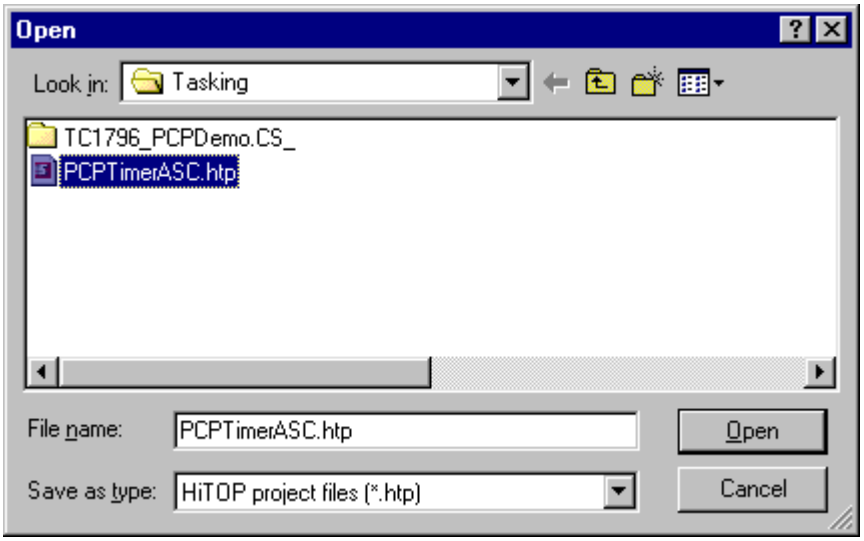
3.1.1 Preparing the Session

To work properly with this example, some assumptions must be made:

1. A debugger must be connected to the target.
2. For testing the ASC0 interrupt, a serial interface must be connected to the board and a terminal program should be opened. For this example we use the following settings:
   - Baud rate 9 600
   - Stop bit 1
   - Parity none
3. If you want to use a preconfigured project, you should download the example from www.hitex.com and extract this zip file into a folder. From here you may load the HiTOP example project into the target (see below).

3.1.2 Using the Example Project

- Start HiTOP and execute HiTOP's **Project > Open** command.
- Select the example project **PCPTimerASC.htp** from the directory, you had copied the example to.



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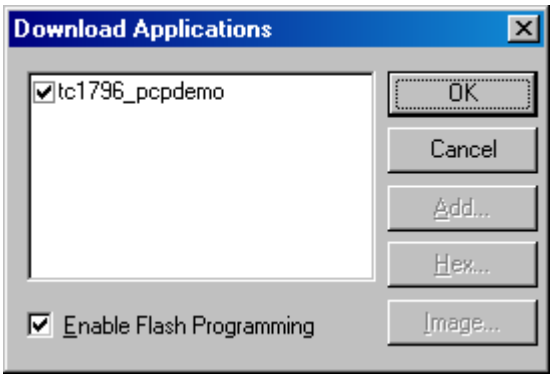
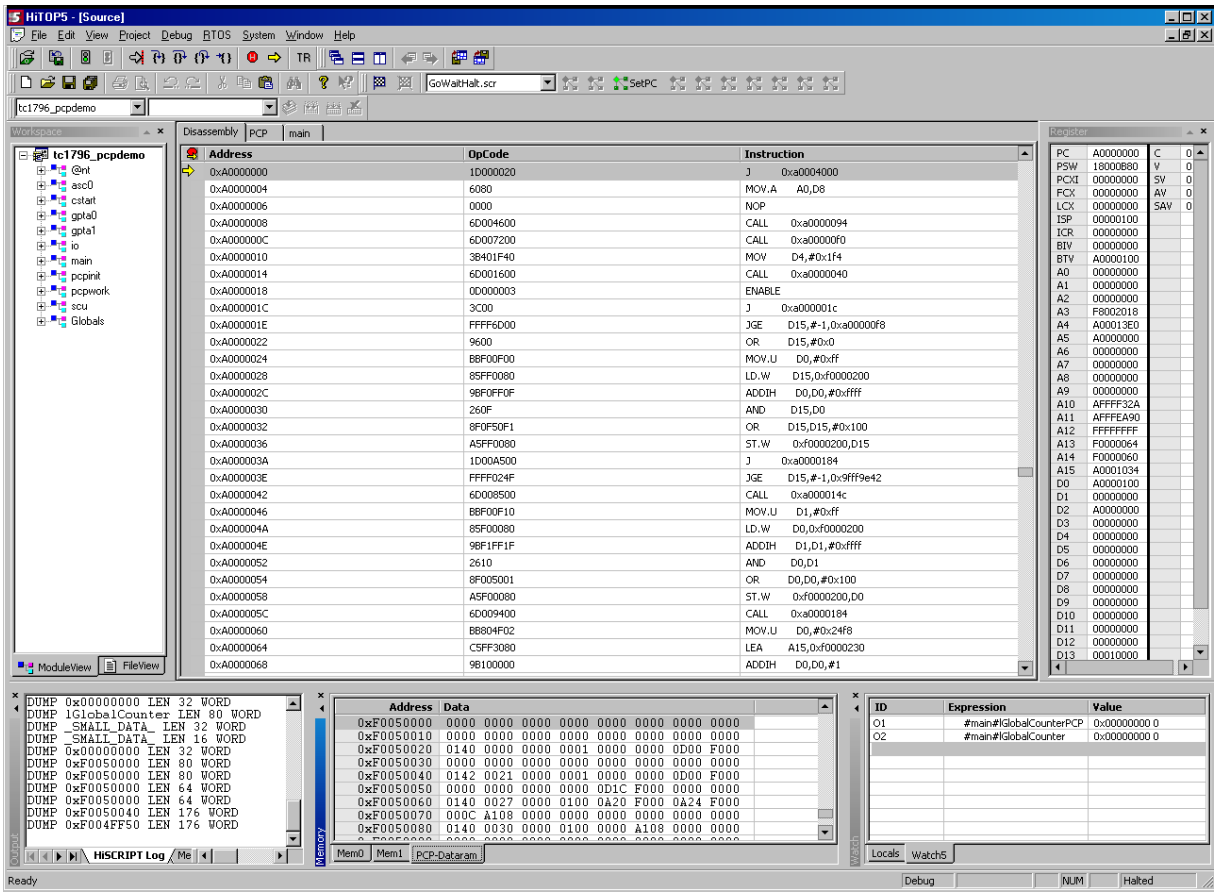
The following dialog will be displayed:



- Click **OK** to download the application **tc1796_pcpdemo**. After downloading, HiTOP will look like this or similar:



Before starting the emulation set the PC has to be set to 0xA1000000, because the example application is linked to this address and the Starterkits usually reset to 0xA0000000, depending on the hardware configuration options. For more information see the **Tricore Starterkit User Manual**.

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- To perform a target reset setting the PC, use the **SetPC** script button provided in the toolbar:

The script linked to this button additionally performs a "Go until main" to ensure that the PCP code is copied into RAM.

- Start the emulation of the TC1796's TriCore by using the **F5** key or by clicking on the **Go** button:

An LED should blink at regular intervals.

- In the **Source** window, switch to the **PCP tab**.
- To debug the PCP, set a breakpoint, e.g. at address PCPCODE:0xXXXXXXXXXX. The PCP will stop the execution with the PCP PC on the breakpoint's address.
- With a single step (**F9** or **F11**) you can step through the code and turn on or off the LED.
- To jump into another channel you just have to set the breakpoints to the following addresses:

Channel	Start Address	Breakpoint Address
1	PCPCODE:0x00000000	PCPCODE:0x00000009
2	PCPCODE:0x00000013	PCPCODE:0x0000001C
3	PCPCODE:0x00000027	PCPCODE:0x00000027
4	PCPCODE:0x00000030	PCPCODE:0x00000030

Note
Channel 1, 2 and 4 are triggered periodically from the timer. Channel 3 will be triggered from the serial interface. To stop at a breakpoint you must send a character via the serial interface.

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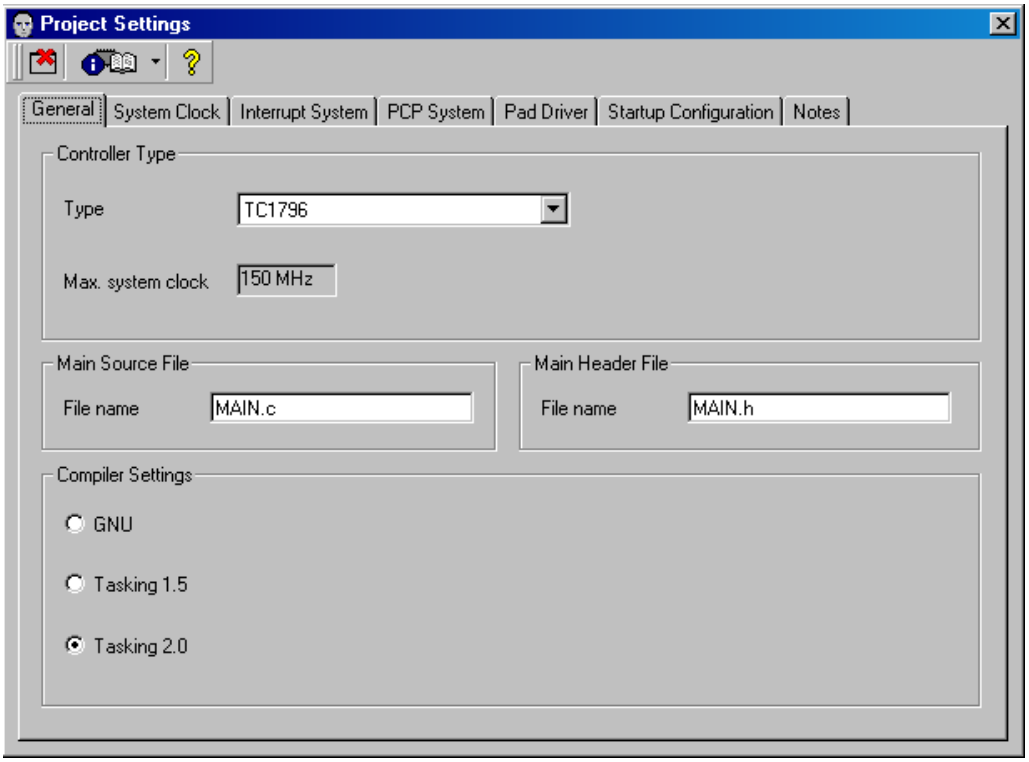
3.2 Generating Framework with DAvE

To work properly with the TriCore and the PCP you have to configure all TriCore SFRs. With **DAvE**, Infineon's **D**igital **A**pplication **v**irtual **E**ngineer, you may create a framework of functions initializing your SFRs. In the following the settings being different to DAvE's default settings are presented.

- Start **DAvE** and create a new TC1796 project. In the **General** tab of the **Project Settings** dialog, select the correct compiler settings:



- In the following dialog you may select your system clock.

These settings depend on the target in use. In this example Infineon's **TC1796 Starterkit** is used working properly with the following configuration:

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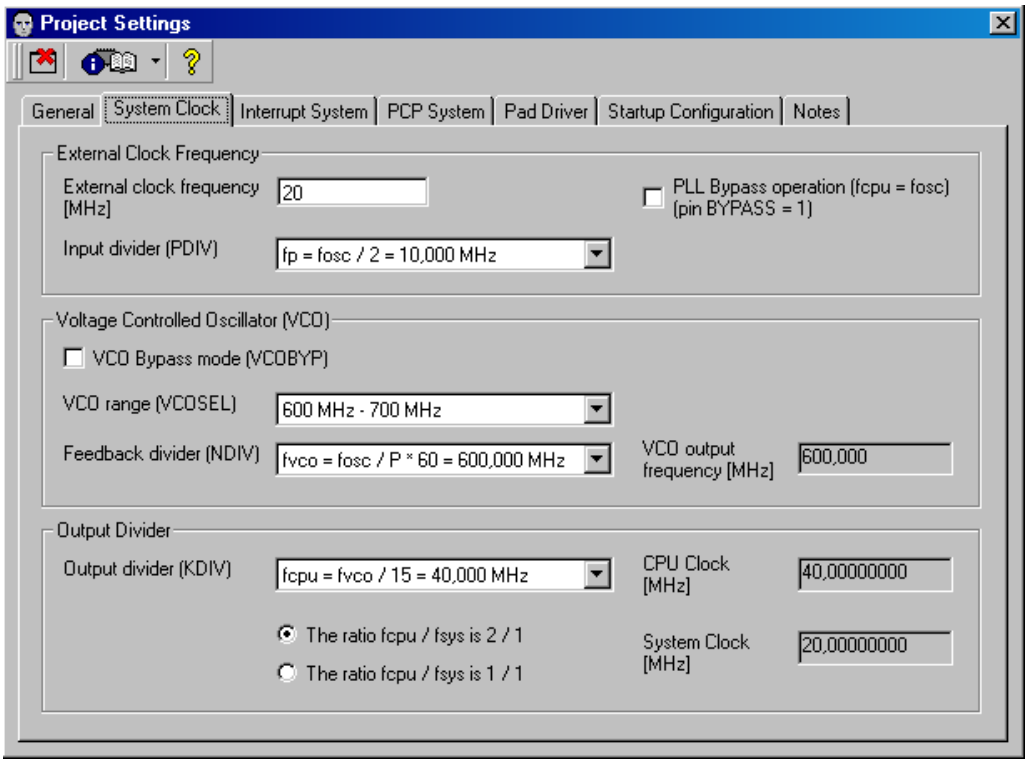
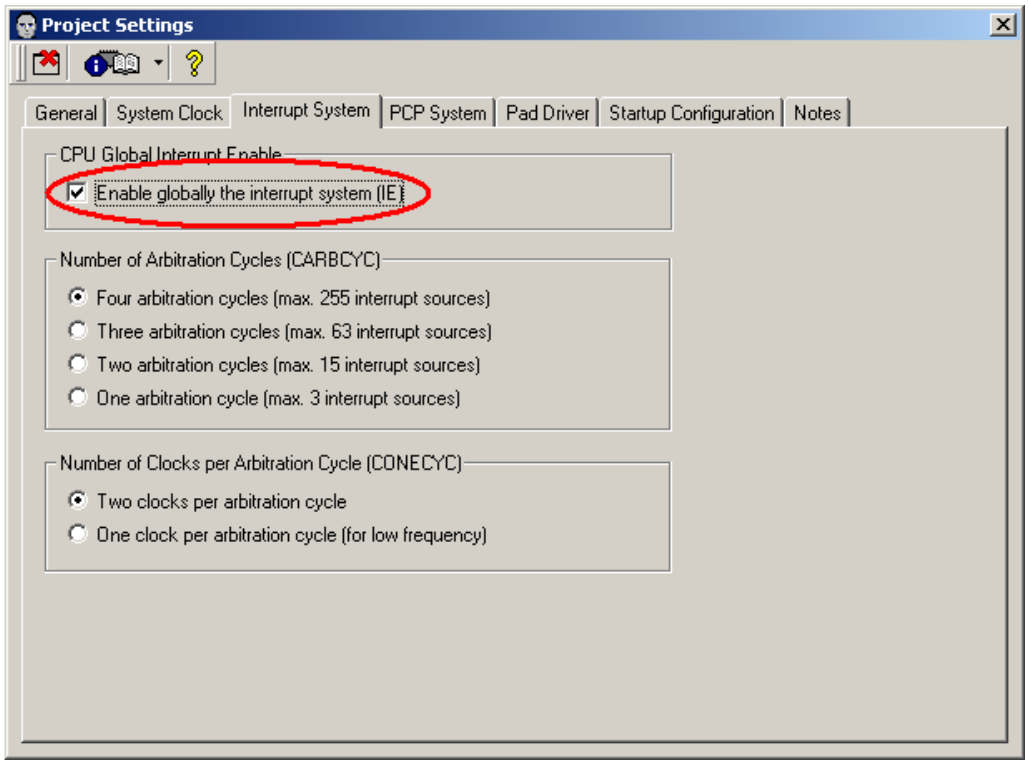


- Do not forget to enable the **Interrupt System** …


Project Settings
General
System Clock
Interrupt System
PCP System
Pad Driver
Startup Configuration
Notes
CPU Global Interrupt Enable
Enable globally the interrupt system (IE)
Number of Arbitration Cycles (CARBCYC)
Four arbitration cycles (max. 255 interrupt sources)
Three arbitration cycles (max. 63 interrupt sources)
Two arbitration cycles (max. 15 interrupt sources)
One arbitration cycle (max. 3 interrupt sources)
Number of Clocks per Arbitration Cycle (CONECYC)
Two clocks per arbitration cycle
One clock per arbitration cycle (for low frequency)

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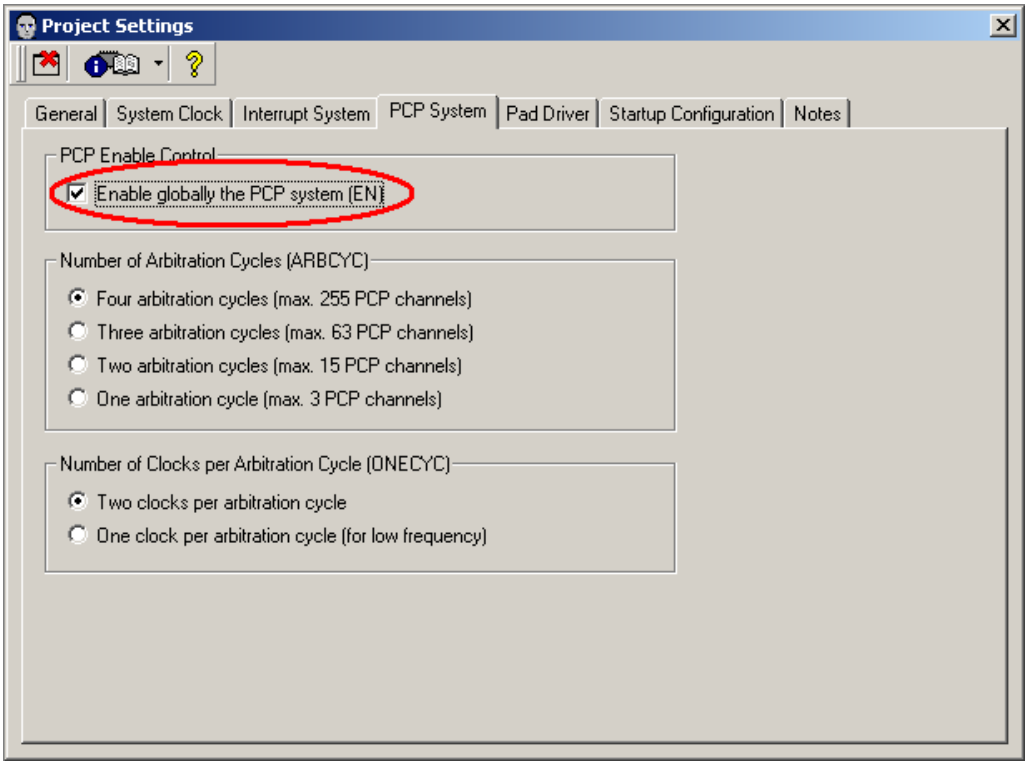
- … and the **PCP System**:


Project Settings
General
System Clock
Interrupt System
PCP System
Pad Driver
Startup Configuration
Notes
PCP Enable Control
Enable globally the PCP system (EN)
Number of Arbitration Cycles (ARBCYC)
Four arbitration cycles (max. 255 PCP channels)
Three arbitration cycles (max. 63 PCP channels)
Two arbitration cycles (max. 15 PCP channels)
One arbitration cycle (max. 3 PCP channels)
Number of Clocks per Arbitration Cycle (ONECYC)
Two clocks per arbitration cycle
One clock per arbitration cycle (for low frequency)

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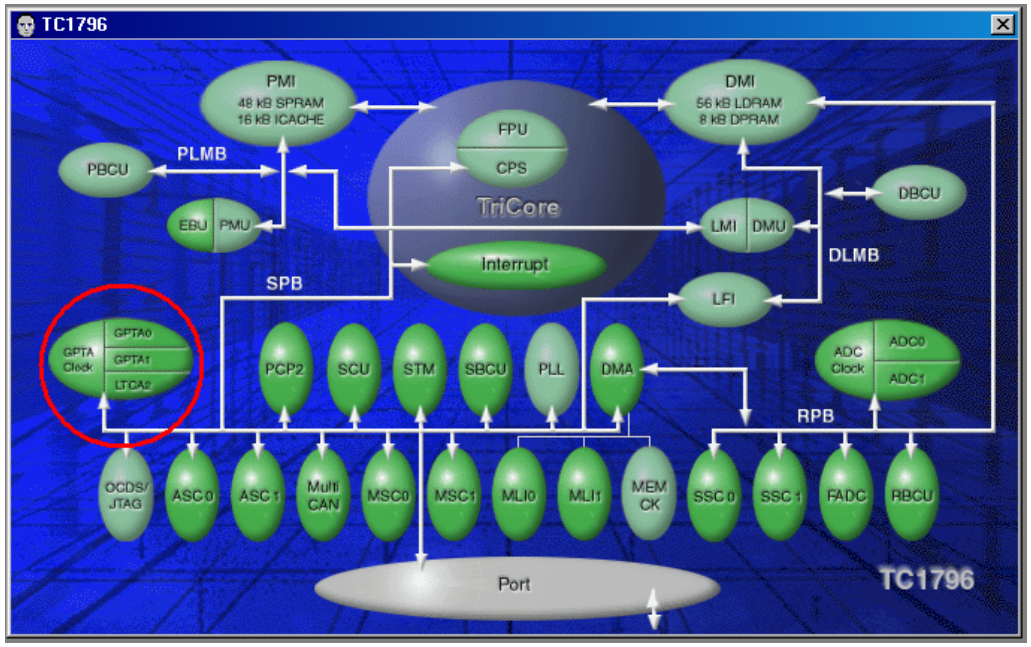
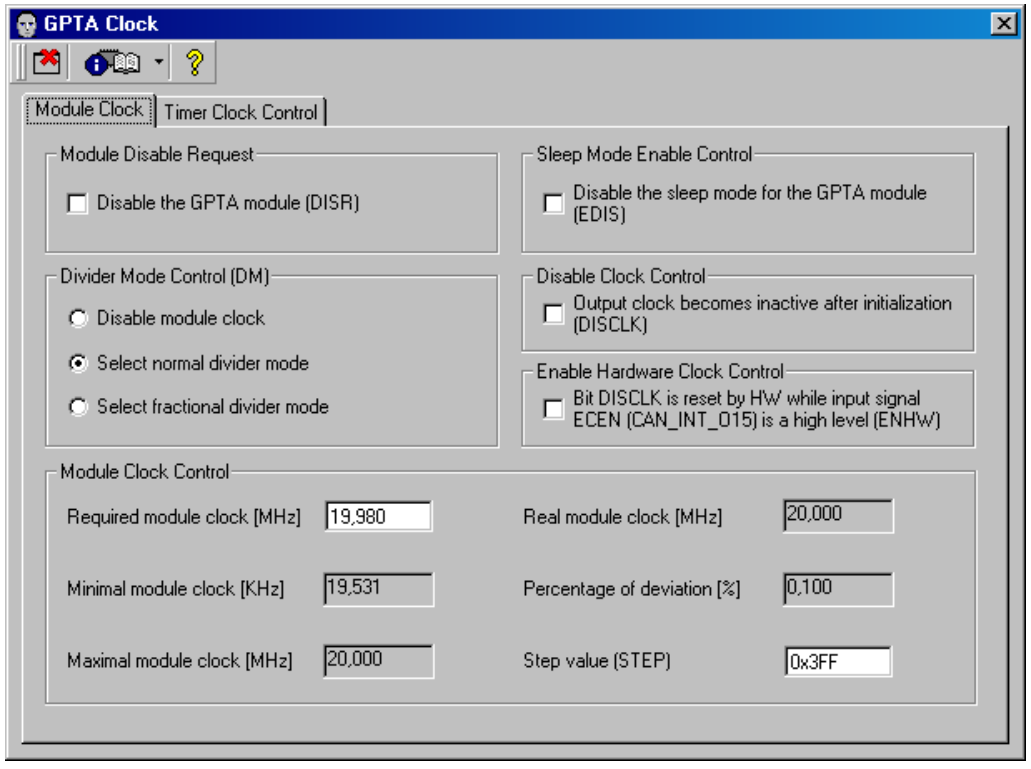
3.2.1 Configuring GPTA

First step is to assign the timer settings to the GPTA.

- Click on the **GPTA clock** area (red-marked in the figure below) and use the following settings:





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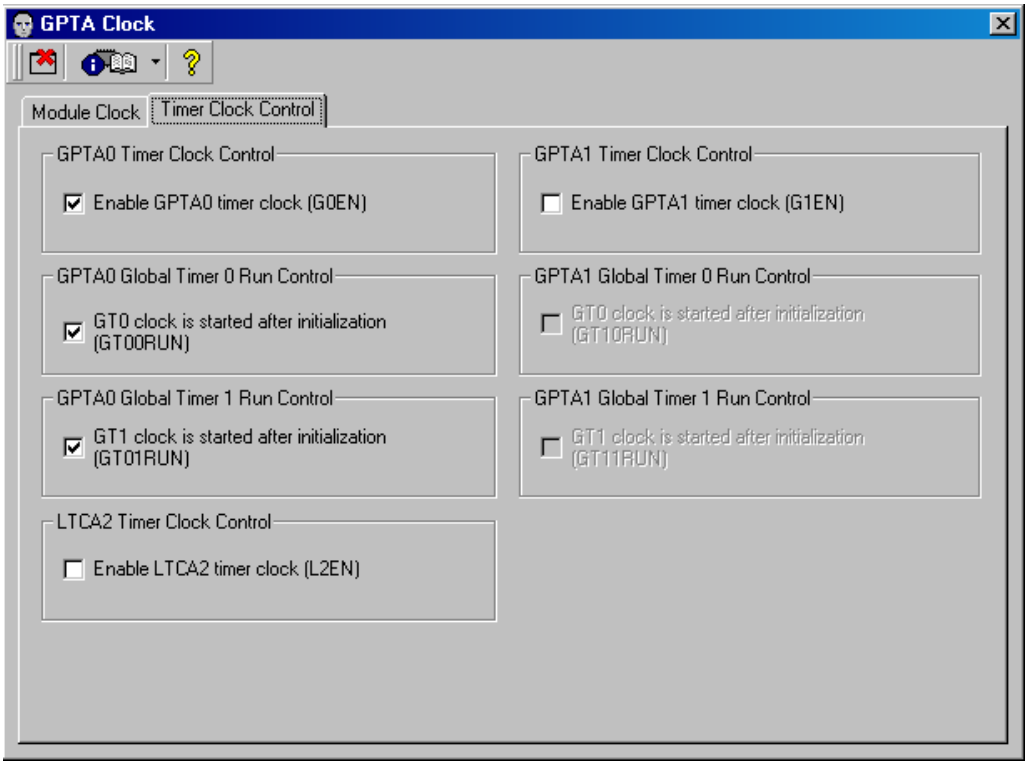
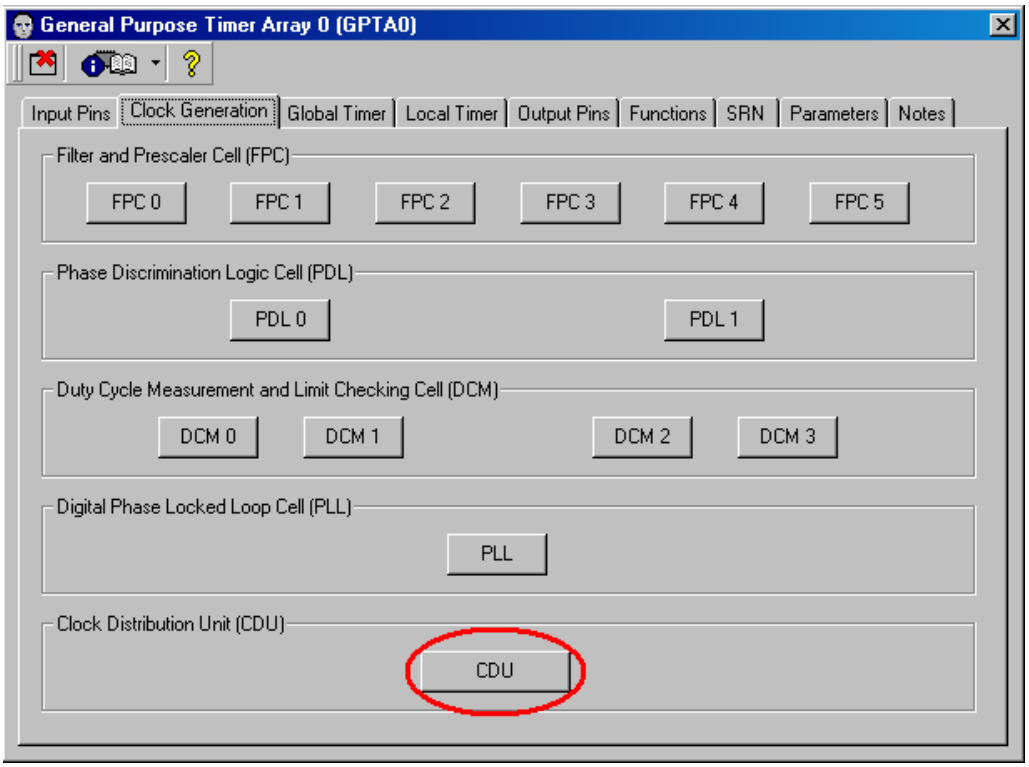

GPTA Clock
Module Clock
Timer Clock Control
GPTA0 Timer Clock Control
Enable GPTA0 timer clock (G0EN)
GPTA1 Timer Clock Control
Enable GPTA1 timer clock (G1EN)
GPTA0 Global Timer 0 Run Control
GT0 clock is started after initialization (GT00RUN)
GPTA1 Global Timer 0 Run Control
GT0 clock is started after initialization (GT10RUN)
GPTA0 Global Timer 1 Run Control
GT1 clock is started after initialization (GT01RUN)
GPTA1 Global Timer 1 Run Control
GT1 clock is started after initialization (GT11RUN)
LTCA2 Timer Clock Control
Enable LTCA2 timer clock (L2EN)

After configuring the GPTA clock module, the **Clock Distribution Unit** has to be configured. This unit dispenses the clock onto seven different clock busses.

- Click on the **CDU** button (see below) and make the settings displayed. Only the clock bus 7 will be different from the default values.



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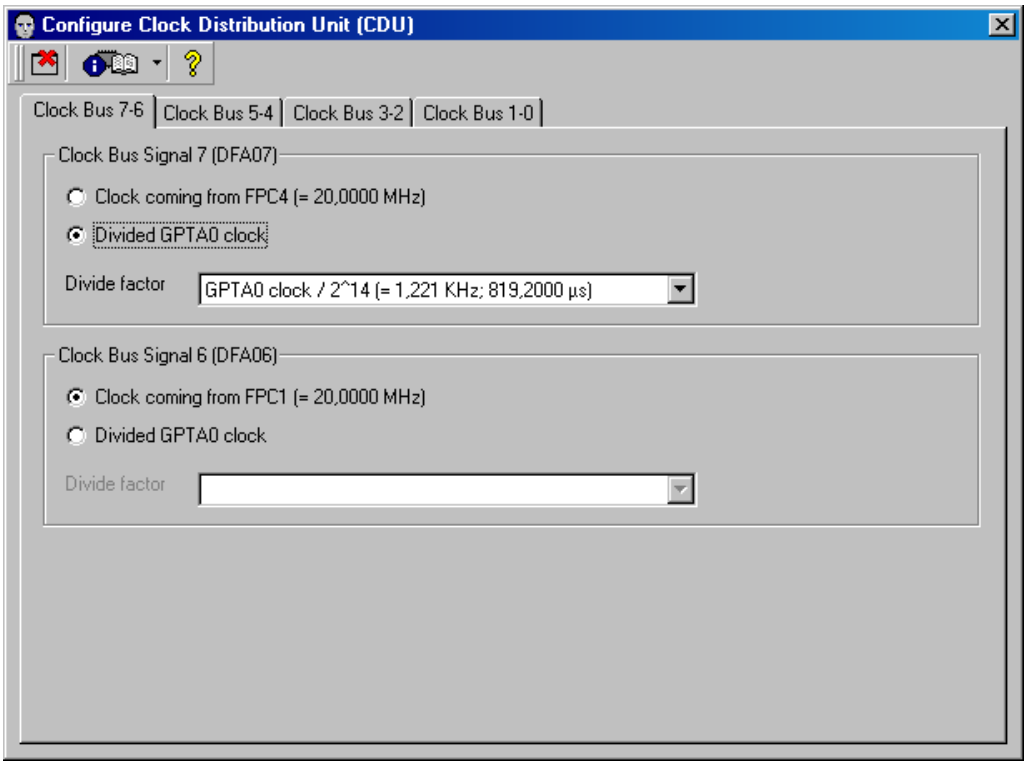
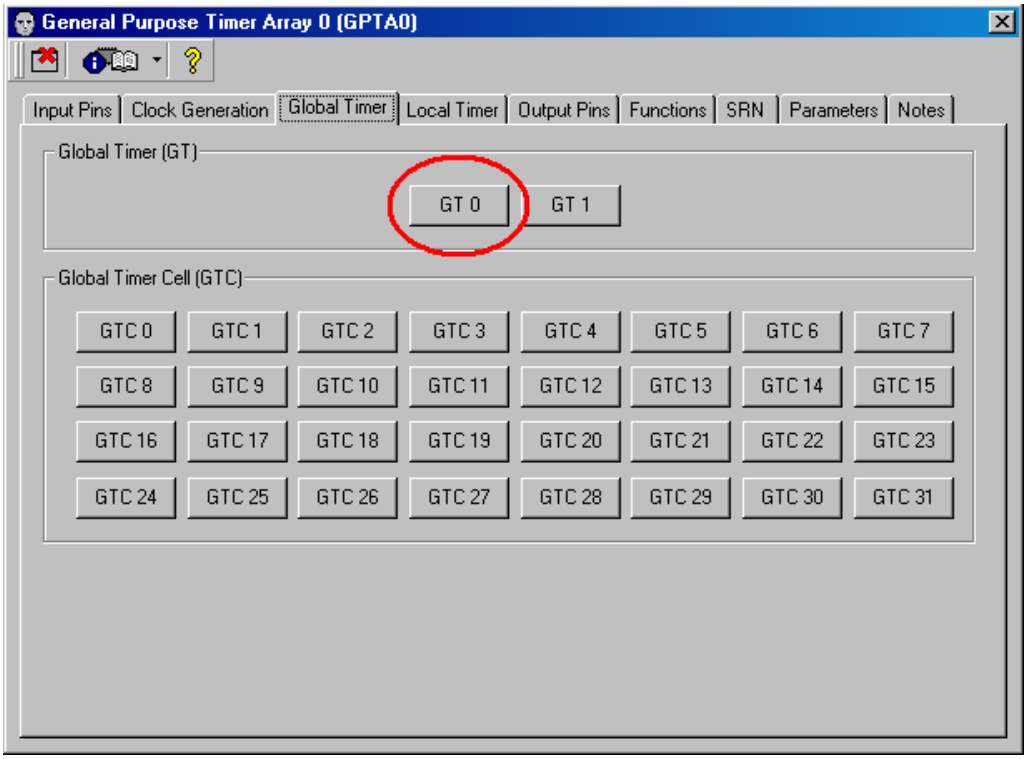

Configure Clock Distribution Unit (CDU)
Clock Bus 7-6
Clock Bus 5-4
Clock Bus 3-2
Clock Bus 1-0
Clock Bus Signal 7 (DFA07)
Clock coming from FPC4 (= 20,0000 MHz)
Divided GPTA0 clock
Divide factor
GPTA0 clock / 2^14 (= 1,221 KHz; 819,2000 µs)
Clock Bus Signal 6 (DFA06)
Clock coming from FPC1 (= 20,0000 MHz)
Divided GPTA0 clock
Divide factor

In the following steps the Global timer 0 and Global timer 1 are configured.

- Click on the **GTO** and **GT1** buttons and make the settings displayed.



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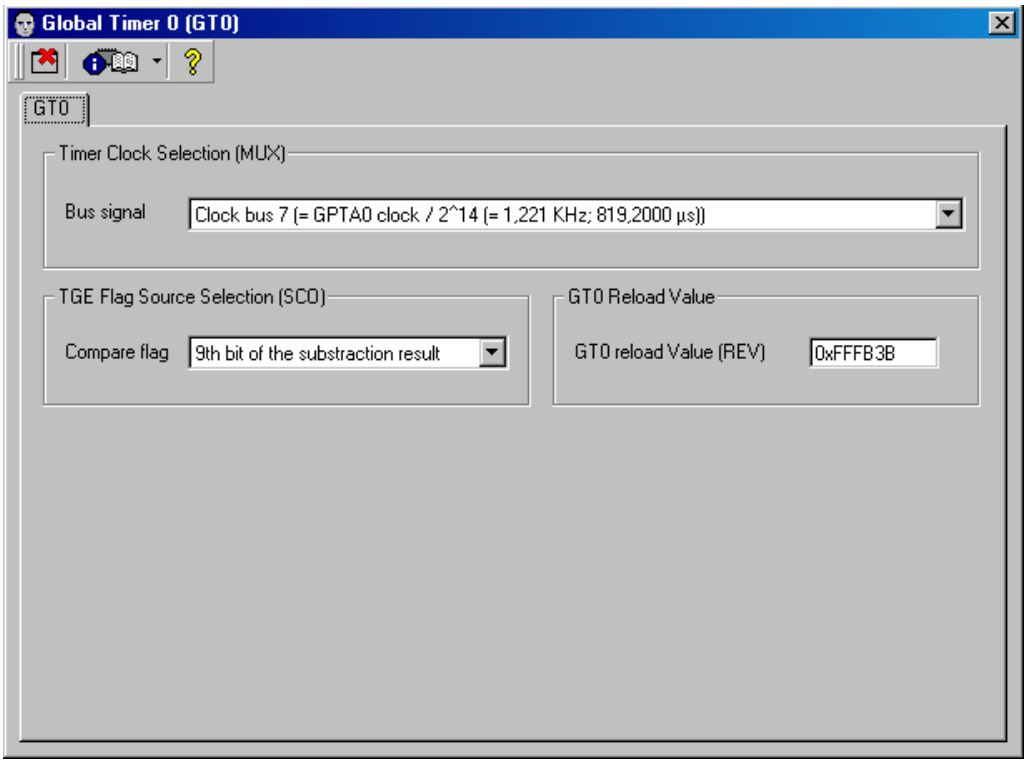
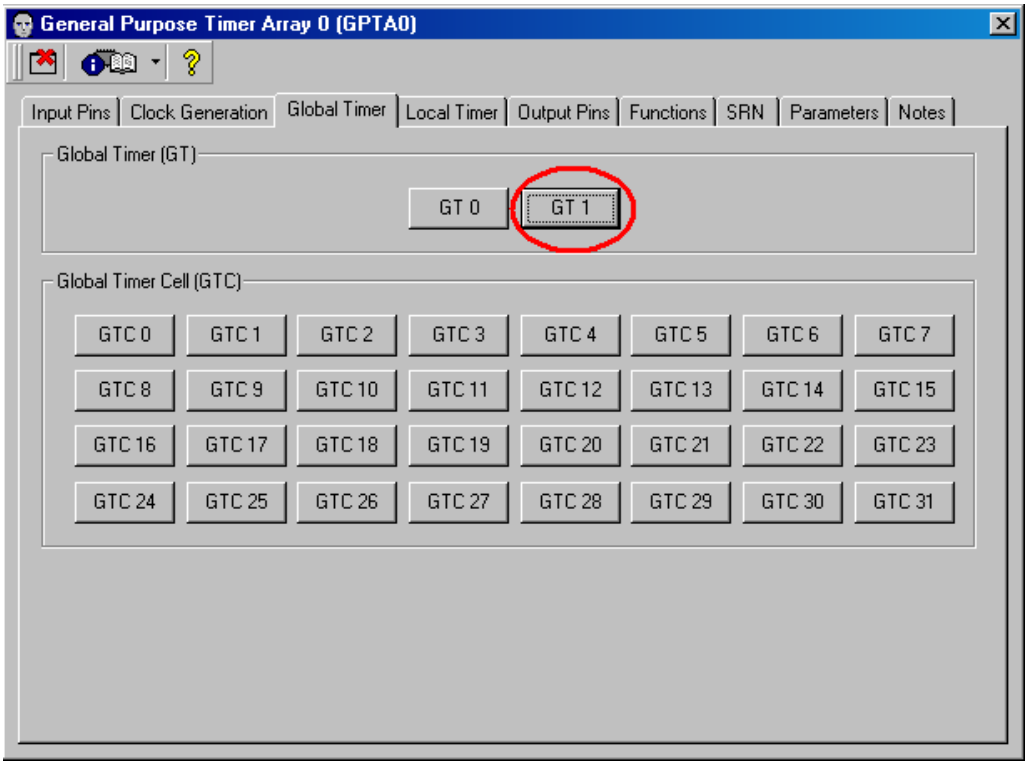

Global Timer 0 (GT0)
GT0
Timer Clock Selection (MUX)
Bus signal
Clock bus 7 (= GPTA0 clock / 2^14 (= 1,221 KHz; 819,2000 µs))
TGE Flag Source Selection (SCO)
Compare flag
9th bit of the substraction result
GT0 Reload Value
GT0 reload Value (REV)
0xFFFB3B

The Global timer 1 interrupts every ½ second.



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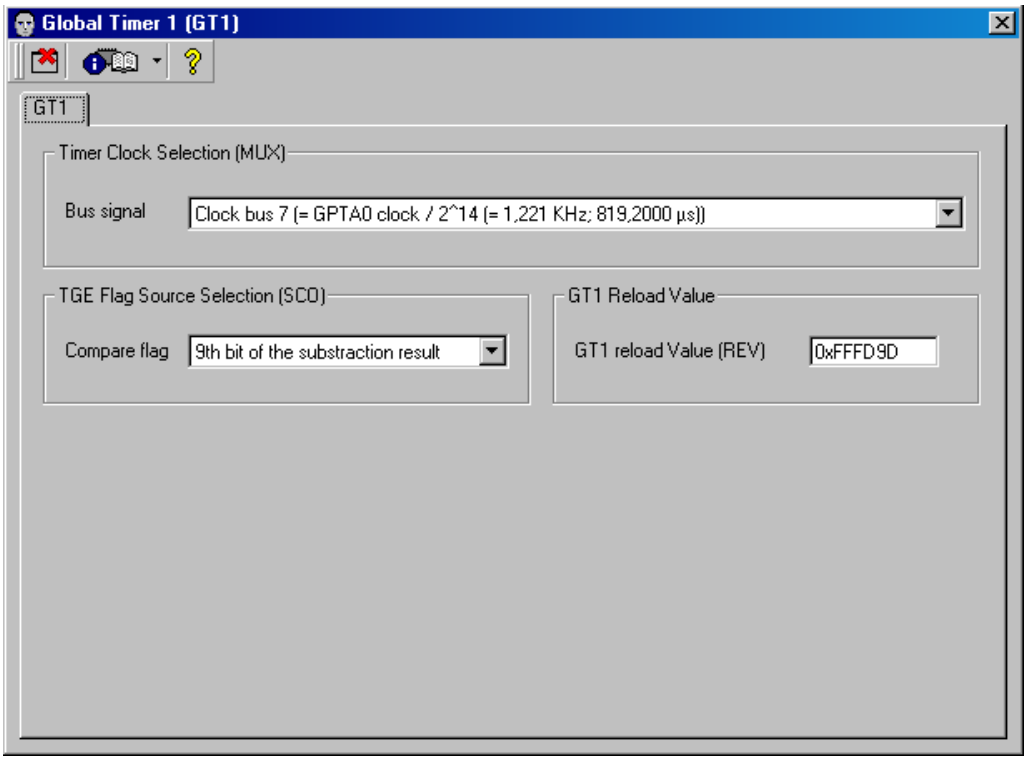
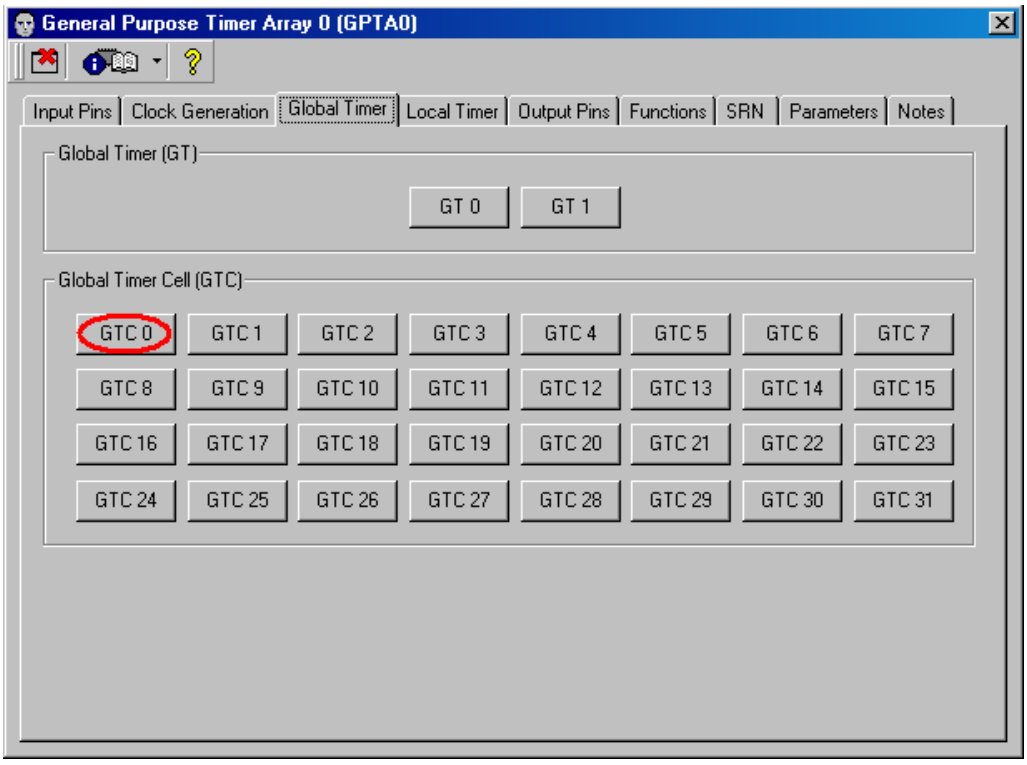

Global Timer 1 (GT1)
GT1
Timer Clock Selection (MUX)
Bus signal
Clock bus 7 (= GPTA0 clock / 2^14 (= 1,221 KHz; 819,2000 µs))
TGE Flag Source Selection (SCO)
Compare flag
9th bit of the substraction result
GT1 Reload Value
GT1 reload Value (REV)
0xFFFD9D

To get different interrupts, we use the global timer cells 0, 8 and 16. Each cell we assign to one SRN of the TriCore. First configure the timer cells.

- Click on the **GTC**, **GTC8** and **GTC16** buttons and make the suggested settings.



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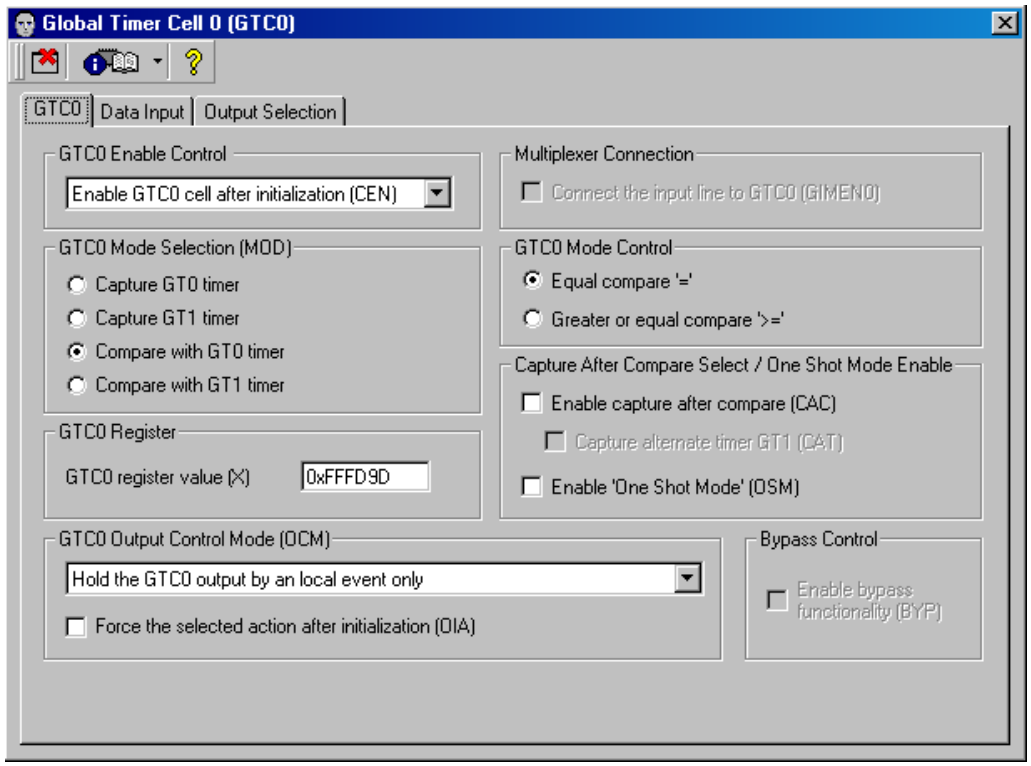
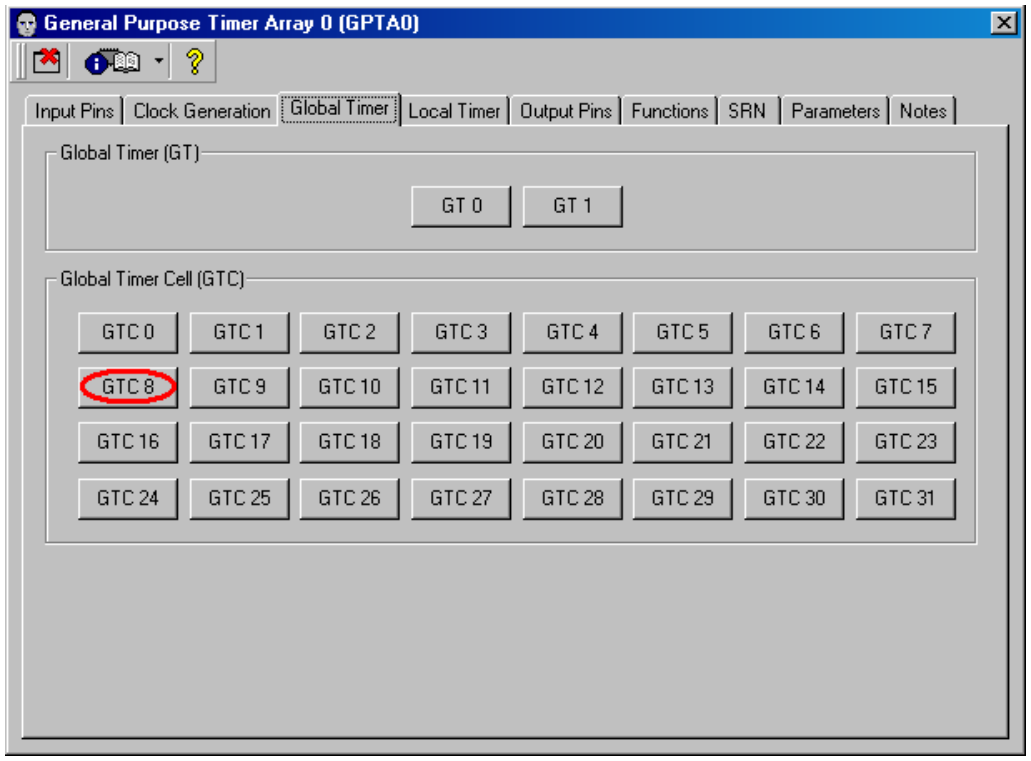

Global Timer Cell 0 (GTC0)
GTC0
Data Input
Output Selection
GTC0 Enable Control
Enable GTC0 cell after initialization (CEN)
Multiplexer Connection
Connect the input line to GTC0 (GIMEN0)
GTC0 Mode Selection (MOD)
Capture GT0 timer
Capture GT1 timer
Compare with GT0 timer
Compare with GT1 timer
GTC0 Mode Control
Equal compare '='
Greater or equal compare '>='
Capture After Compare Select / One Shot Mode Enable
Enable capture after compare (CAC)
Capture alternate timer GT1 (CAT)
Enable 'One Shot Mode' (OSM)
GTC0 Register
GTC0 register value (X)
0xFFFD9D
GTC0 Output Control Mode (OCM)
Hold the GTC0 output by an local event only
Force the selected action after initialization (OIA)
Bypass Control
Enable bypass functionality (BYP)



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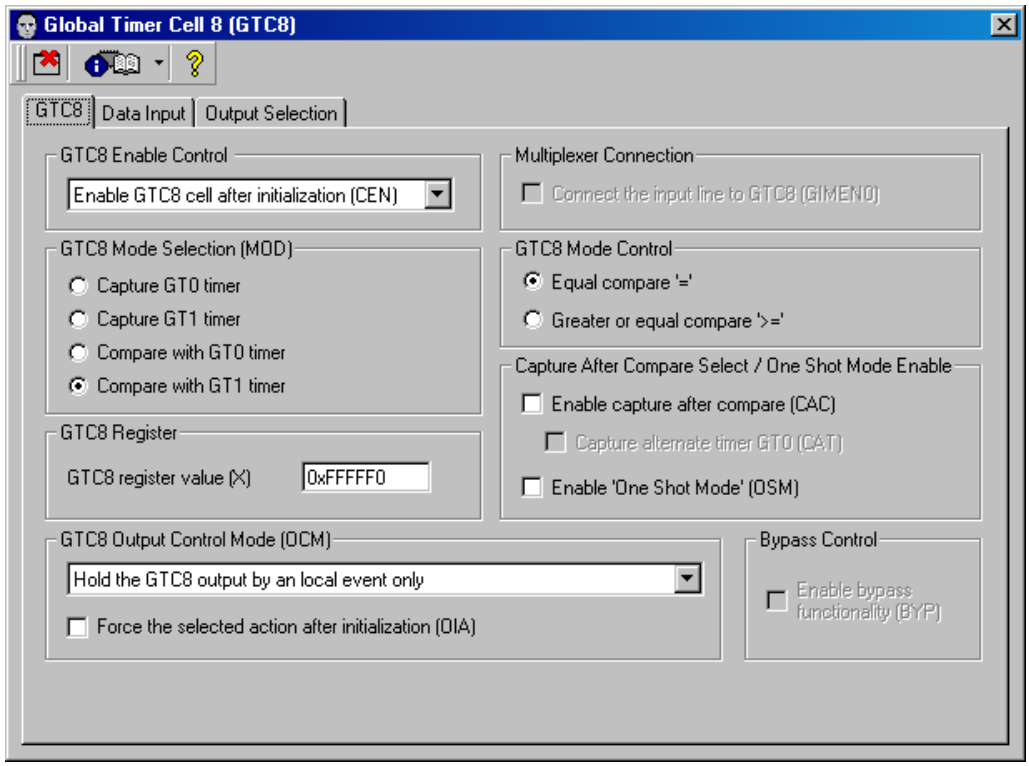
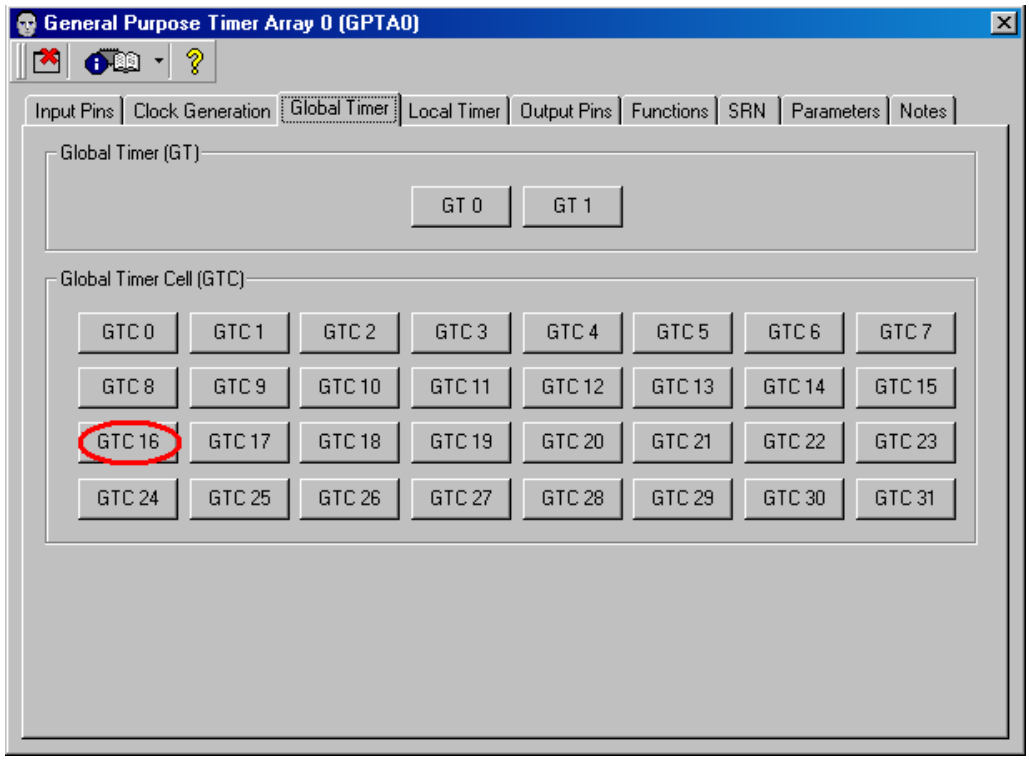

Global Timer Cell 8 (GTC8)
GTC8
Data Input
Output Selection
GTC8 Enable Control
Enable GTC8 cell after initialization (CEN)
Multiplexer Connection
Connect the input line to GTC8 (GIMEN0)
GTC8 Mode Selection (MOD)
Capture GT0 timer
Capture GT1 timer
Compare with GT0 timer
Compare with GT1 timer
GTC8 Mode Control
Equal compare '='
Greater or equal compare '>='
Capture After Compare Select / One Shot Mode Enable
Enable capture after compare (CAC)
Capture alternate timer GT0 (CAT)
Enable 'One Shot Mode' (OSM)
GTC8 Register
GTC8 register value (X)
0xFFFFF0
GTC8 Output Control Mode (OCM)
Hold the GTC8 output by an local event only
Force the selected action after initialization (OIA)
Bypass Control
Enable bypass functionality (BYP)



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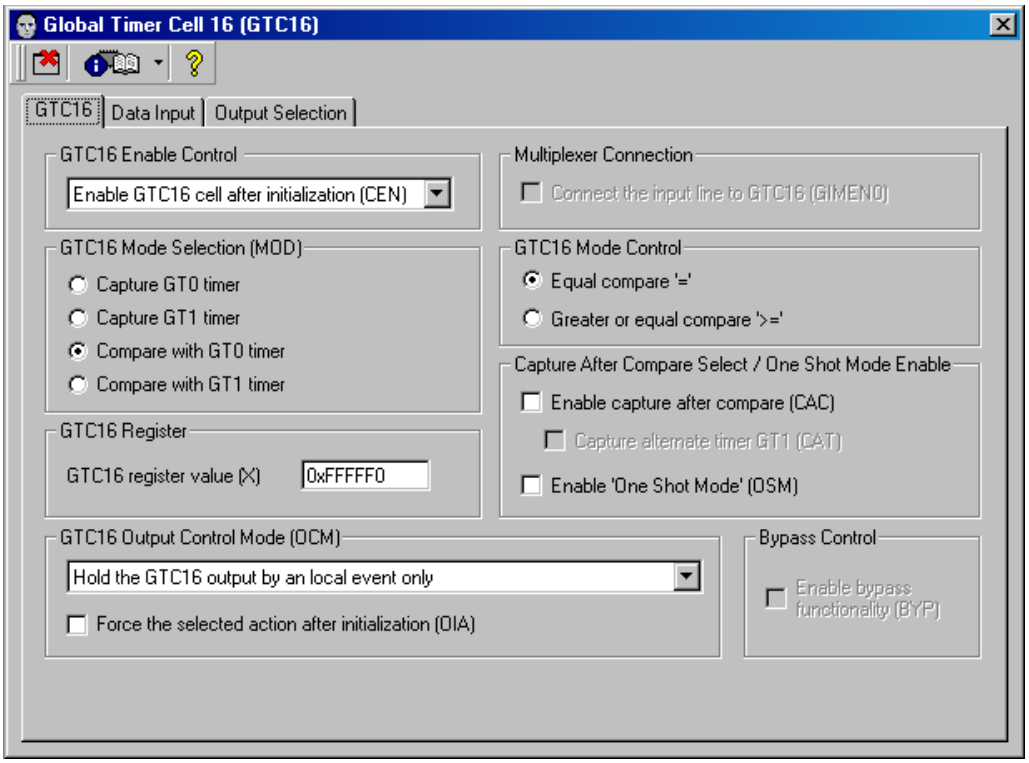
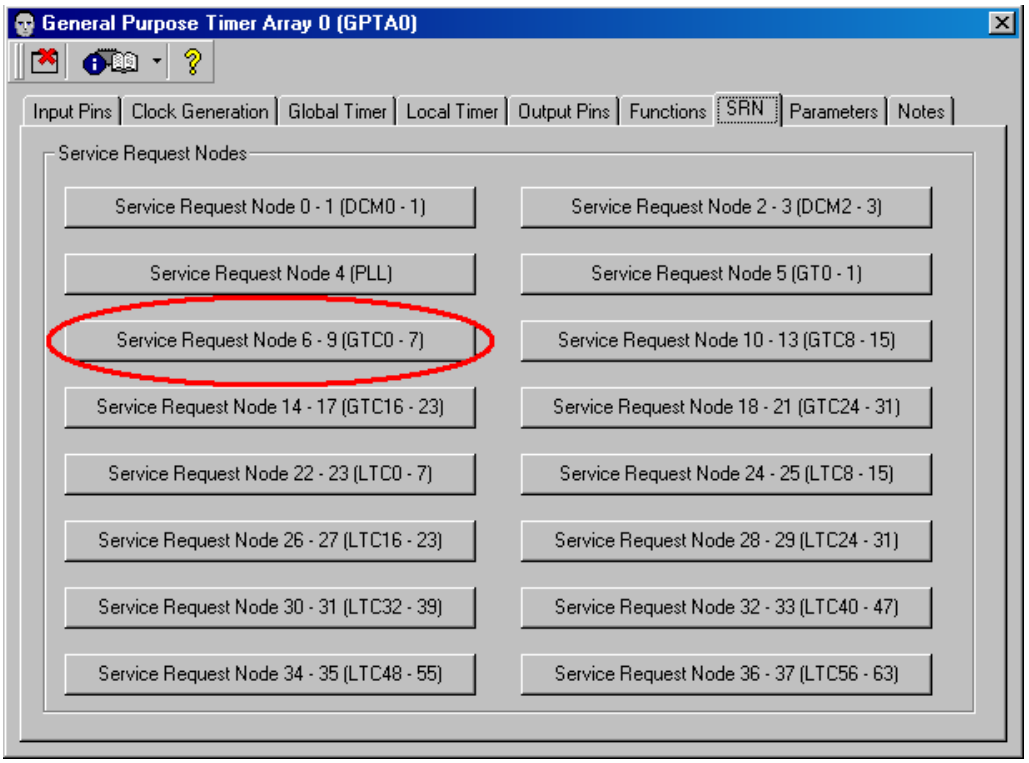

Global Timer Cell 16 (GTC16)
GTC16
Data Input
Output Selection
GTC16 Enable Control
Enable GTC16 cell after initialization (CEN)
Multiplexer Connection
Connect the input line to GTC16 (GIMEN0)
GTC16 Mode Selection (MOD)
Capture GT0 timer
Capture GT1 timer
Compare with GT0 timer
Compare with GT1 timer
GTC16 Mode Control
Equal compare '='
Greater or equal compare '>='
Capture After Compare Select / One Shot Mode Enable
Enable capture after compare (CAC)
Capture alternate timer GT1 (CAT)
Enable 'One Shot Mode' (OSM)
GTC16 Register
GTC16 register value (X)
0xFFFFF0
GTC16 Output Control Mode (OCM)
Hold the GTC16 output by an local event only
Force the selected action after initialization (OIA)
Bypass Control
Enable bypass functionality (BYP)

After configuring the timer, the service request nodes of the GPTA must be defined.

- Use the buttons marked in the following figures, and then make the required settings.


General Purpose Timer Array 0 (GPTA0)
Input Pins
Clock Generation
Global Timer
Local Timer
Output Pins
Functions
SRN
Parameters
Notes
Service Request Nodes
Service Request Node 0 - 1 (DCM0 - 1)
Service Request Node 2 - 3 (DCM2 - 3)
Service Request Node 4 (PLL)
Service Request Node 5 (GT0 - 1)
Service Request Node 6 - 9 (GTC0 - 7)
Service Request Node 10 - 13 (GTC8 - 15)
Service Request Node 14 - 17 (GTC16 - 23)
Service Request Node 18 - 21 (GTC24 - 31)
Service Request Node 22 - 23 (LTC0 - 7)
Service Request Node 24 - 25 (LTC8 - 15)
Service Request Node 26 - 27 (LTC16 - 23)
Service Request Node 28 - 29 (LTC24 - 31)
Service Request Node 30 - 31 (LTC32 - 39)
Service Request Node 32 - 33 (LTC40 - 47)
Service Request Node 34 - 35 (LTC48 - 55)
Service Request Node 36 - 37 (LTC56 - 63)

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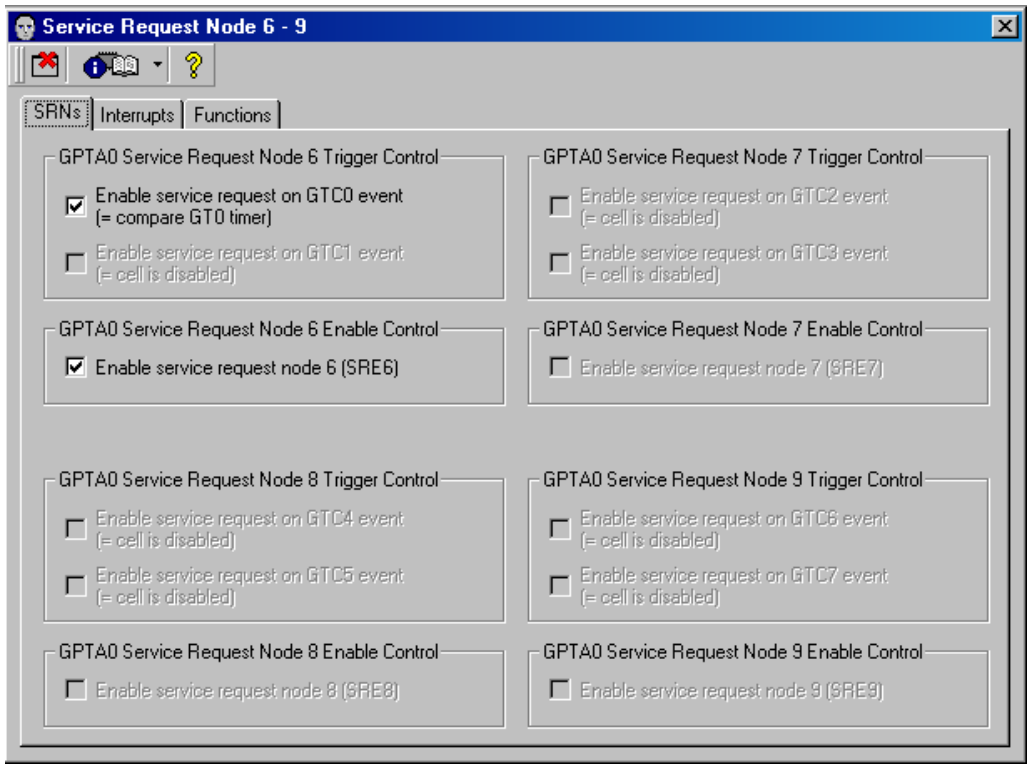
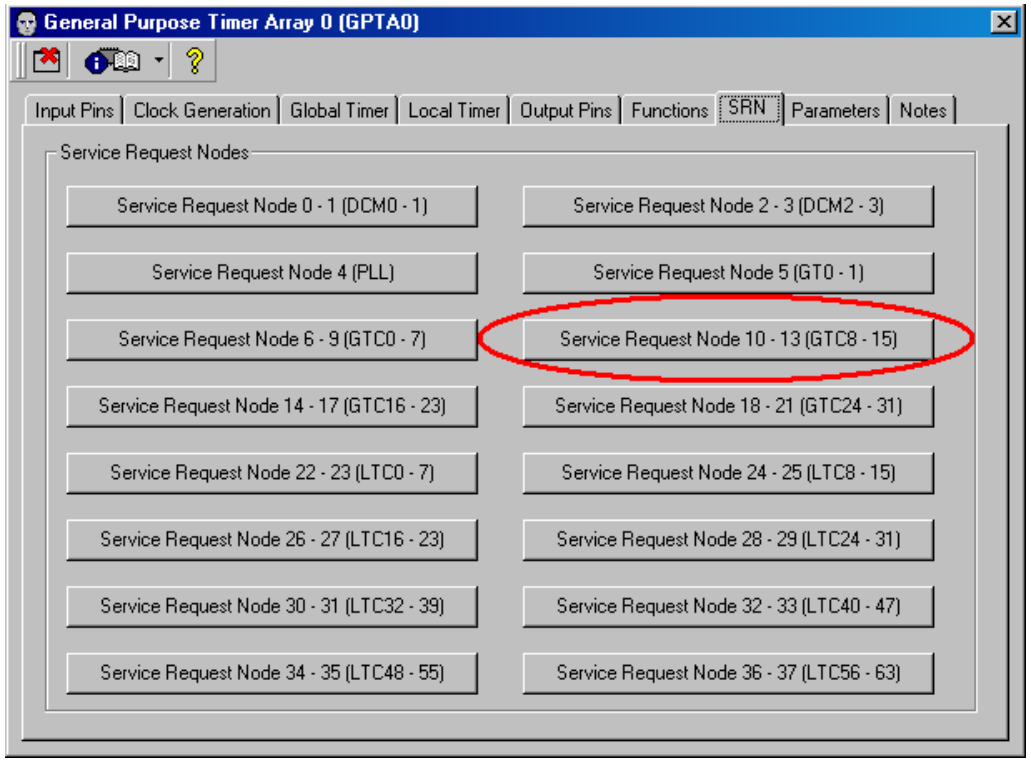

Service Request Node 6 - 9
SRNs
Interrupts
Functions
GPTA0 Service Request Node 6 Trigger Control
Enable service request on GTC0 event (= compare GT0 timer)
Enable service request on GTC1 event (= cell is disabled)
GPTA0 Service Request Node 7 Trigger Control
Enable service request on GTC2 event (= cell is disabled)
Enable service request on GTC3 event (= cell is disabled)
GPTA0 Service Request Node 6 Enable Control
Enable service request node 6 (SRE6)
GPTA0 Service Request Node 7 Enable Control
Enable service request node 7 (SRE7)
GPTA0 Service Request Node 8 Trigger Control
Enable service request on GTC4 event (= cell is disabled)
Enable service request on GTC5 event (= cell is disabled)
GPTA0 Service Request Node 9 Trigger Control
Enable service request on GTC6 event (= cell is disabled)
Enable service request on GTC7 event (= cell is disabled)
GPTA0 Service Request Node 8 Enable Control
Enable service request node 8 (SRE8)
GPTA0 Service Request Node 9 Enable Control
Enable service request node 9 (SRE9)


General Purpose Timer Array 0 (GPTA0)
Input Pins
Clock Generation
Global Timer
Local Timer
Output Pins
Functions
SRN
Parameters
Notes
Service Request Nodes
Service Request Node 0 - 1 (DCM0 - 1)
Service Request Node 2 - 3 (DCM2 - 3)
Service Request Node 4 (PLL)
Service Request Node 5 (GT0 - 1)
Service Request Node 6 - 9 (GTC0 - 7)
Service Request Node 10 - 13 (GTC8 - 15)
Service Request Node 14 - 17 (GTC16 - 23)
Service Request Node 18 - 21 (GTC24 - 31)
Service Request Node 22 - 23 (LTC0 - 7)
Service Request Node 24 - 25 (LTC8 - 15)
Service Request Node 26 - 27 (LTC16 - 23)
Service Request Node 28 - 29 (LTC24 - 31)
Service Request Node 30 - 31 (LTC32 - 39)
Service Request Node 32 - 33 (LTC40 - 47)
Service Request Node 34 - 35 (LTC48 - 55)
Service Request Node 36 - 37 (LTC56 - 63)

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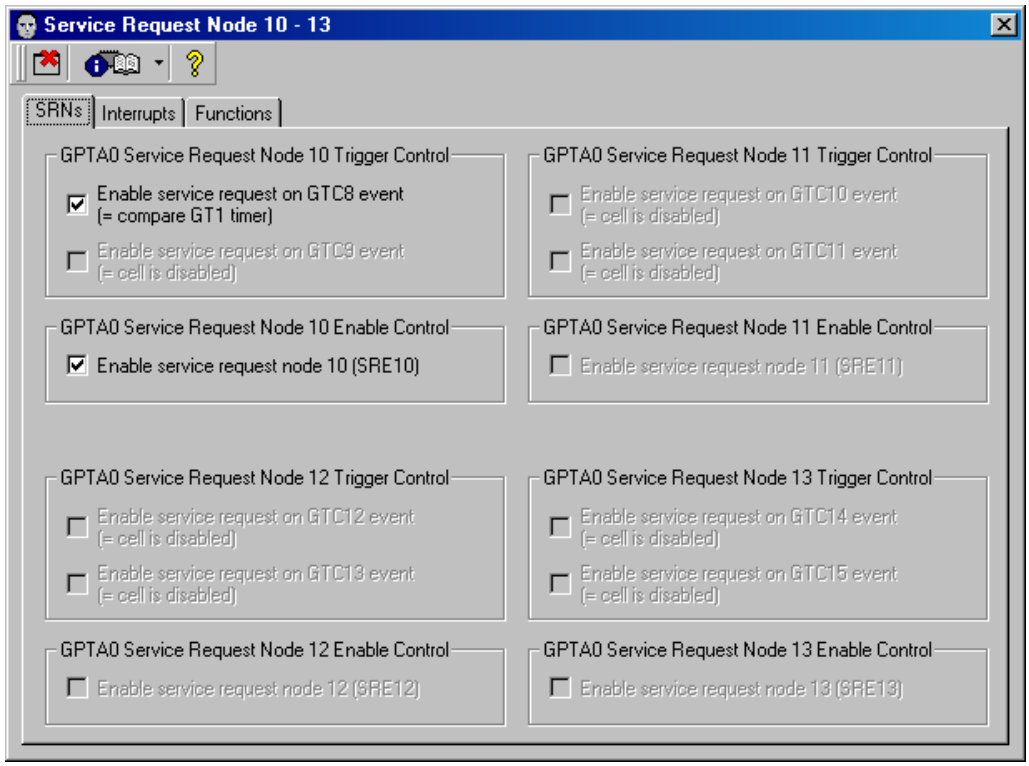
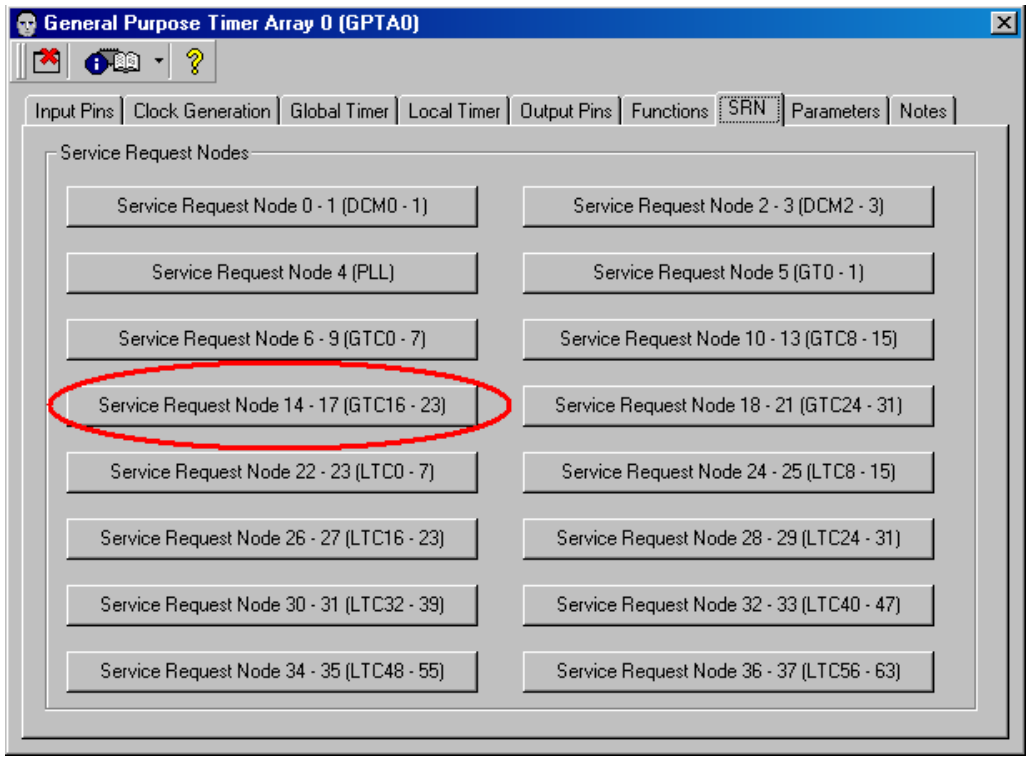

Service Request Node 10 - 13
SRNs
Interrupts
Functions
GPTA0 Service Request Node 10 Trigger Control
Enable service request on GTC8 event (= compare GT1 timer)
Enable service request on GTC9 event (= cell is disabled)
GPTA0 Service Request Node 11 Trigger Control
Enable service request on GTC10 event (= cell is disabled)
Enable service request on GTC11 event (= cell is disabled)
GPTA0 Service Request Node 10 Enable Control
Enable service request node 10 (SRE10)
GPTA0 Service Request Node 11 Enable Control
Enable service request node 11 (SRE11)
GPTA0 Service Request Node 12 Trigger Control
Enable service request on GTC12 event (= cell is disabled)
Enable service request on GTC13 event (= cell is disabled)
GPTA0 Service Request Node 13 Trigger Control
Enable service request on GTC14 event (= cell is disabled)
Enable service request on GTC15 event (= cell is disabled)
GPTA0 Service Request Node 12 Enable Control
Enable service request node 12 (SRE12)
GPTA0 Service Request Node 13 Enable Control
Enable service request node 13 (SRE13)


General Purpose Timer Array 0 (GPTA0)
Input Pins
Clock Generation
Global Timer
Local Timer
Output Pins
Functions
SRN
Parameters
Notes
Service Request Nodes
Service Request Node 0 - 1 (DCM0 - 1)
Service Request Node 2 - 3 (DCM2 - 3)
Service Request Node 4 (PLL)
Service Request Node 5 (GT0 - 1)
Service Request Node 6 - 9 (GTC0 - 7)
Service Request Node 10 - 13 (GTC8 - 15)
Service Request Node 14 - 17 (GTC16 - 23)
Service Request Node 18 - 21 (GTC24 - 31)
Service Request Node 22 - 23 (LTC0 - 7)
Service Request Node 24 - 25 (LTC8 - 15)
Service Request Node 26 - 27 (LTC16 - 23)
Service Request Node 28 - 29 (LTC24 - 31)
Service Request Node 30 - 31 (LTC32 - 39)
Service Request Node 32 - 33 (LTC40 - 47)
Service Request Node 34 - 35 (LTC48 - 55)
Service Request Node 36 - 37 (LTC56 - 63)

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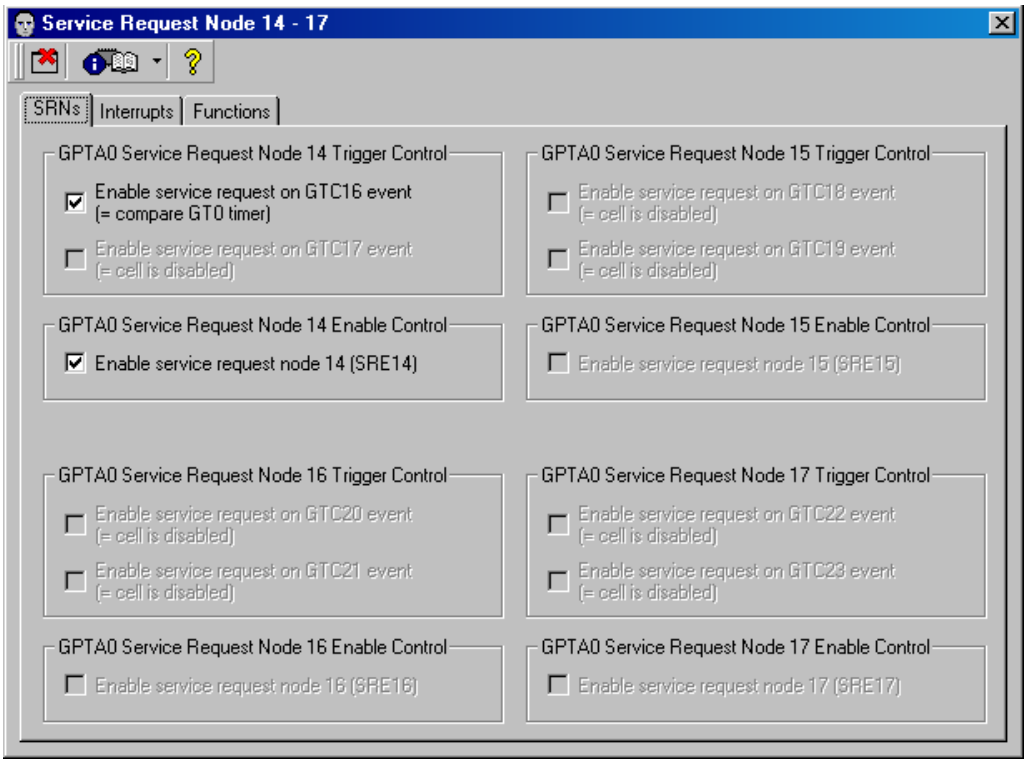
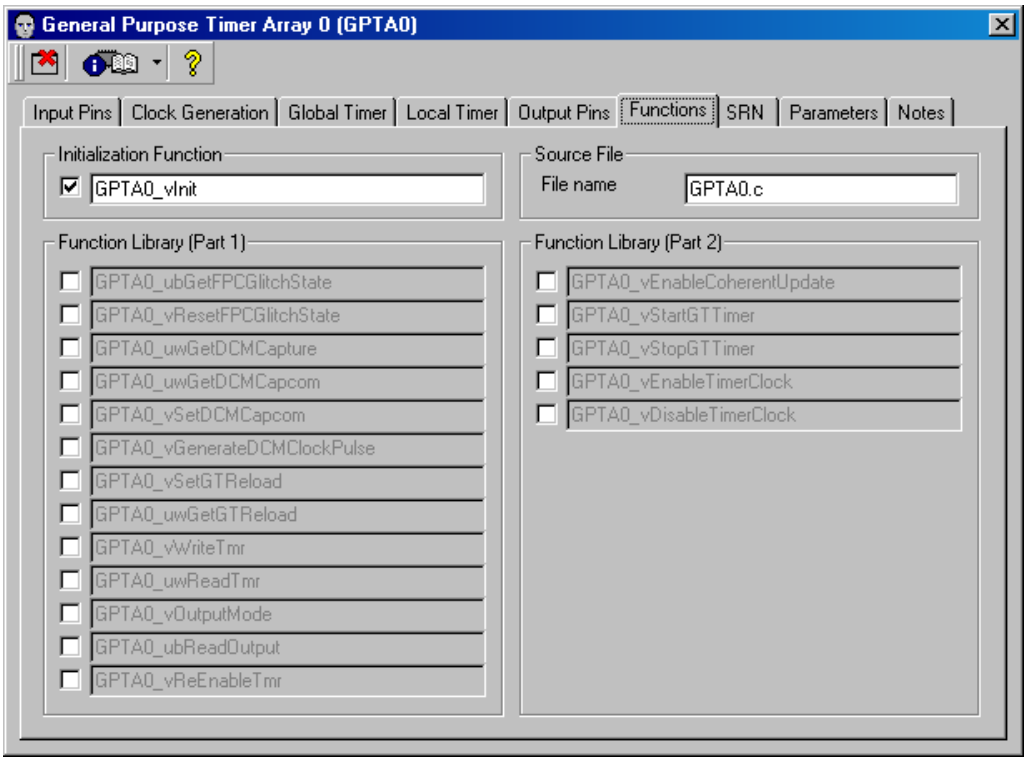

Service Request Node 14 - 17
SRNs
Interrupts
Functions
GPTA0 Service Request Node 14 Trigger Control
Enable service request on GTC16 event (= compare GT0 timer)
Enable service request on GTC17 event (= cell is disabled)
GPTA0 Service Request Node 15 Trigger Control
Enable service request on GTC18 event (= cell is disabled)
Enable service request on GTC19 event (= cell is disabled)
GPTA0 Service Request Node 14 Enable Control
Enable service request node 14 (SRE14)
GPTA0 Service Request Node 15 Enable Control
Enable service request node 15 (SRE15)
GPTA0 Service Request Node 16 Trigger Control
Enable service request on GTC20 event (= cell is disabled)
Enable service request on GTC21 event (= cell is disabled)
GPTA0 Service Request Node 17 Trigger Control
Enable service request on GTC22 event (= cell is disabled)
Enable service request on GTC23 event (= cell is disabled)
GPTA0 Service Request Node 16 Enable Control
Enable service request node 16 (SRE16)
GPTA0 Service Request Node 17 Enable Control
Enable service request node 17 (SRE17)

- Finally select the functions you want to be created by DAvE. Select at least **GPTA0_vInit**.



Note
DAvE will create any source file only if you selected the init function.

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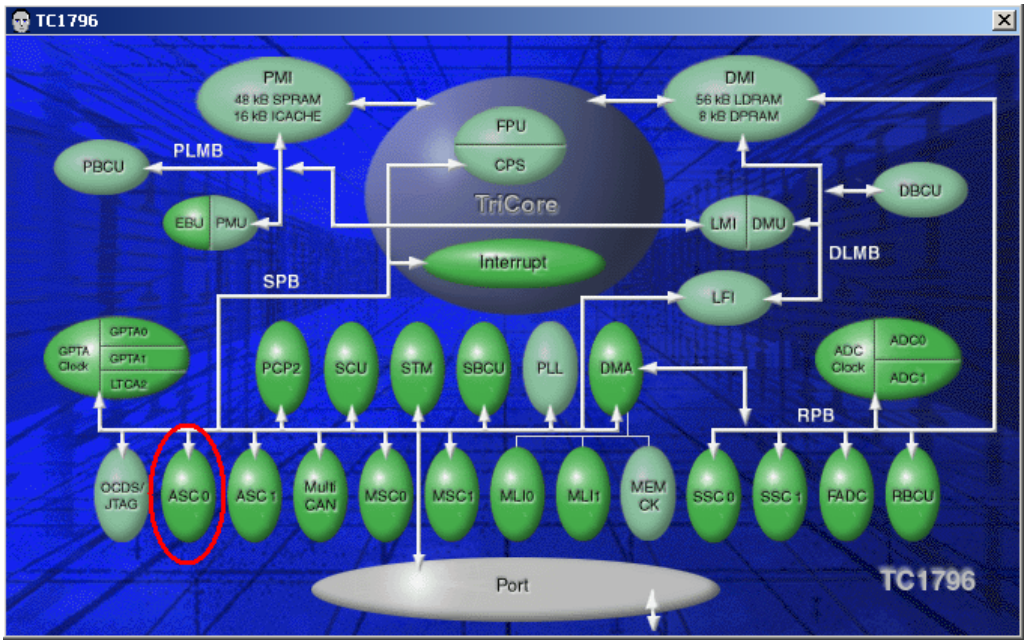
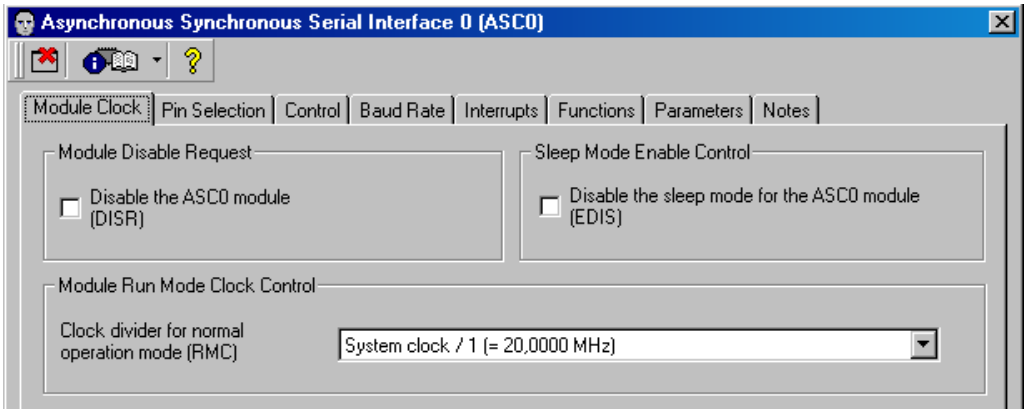
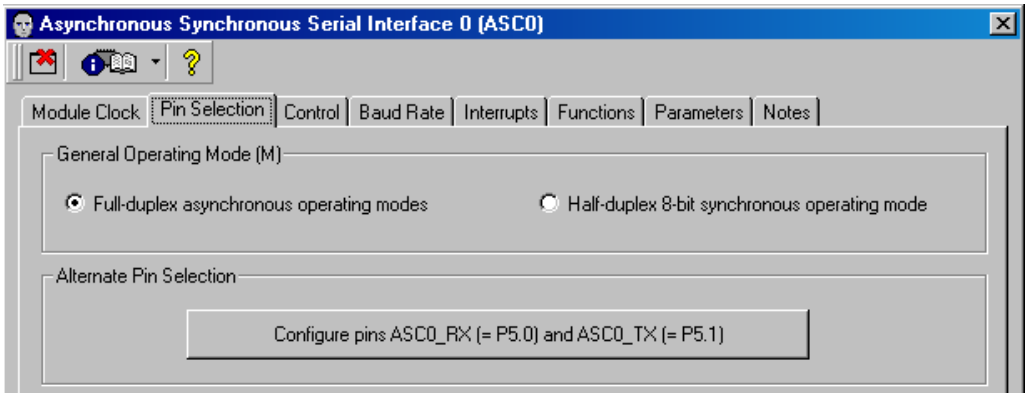
3.2.2 Configuring ASC0

To get interrupts from the serial port you will have to configure ASC0.

- In the DAvE main screen click on the **ASC0** peripheral (red-marked in the figure below) and make the following settings.







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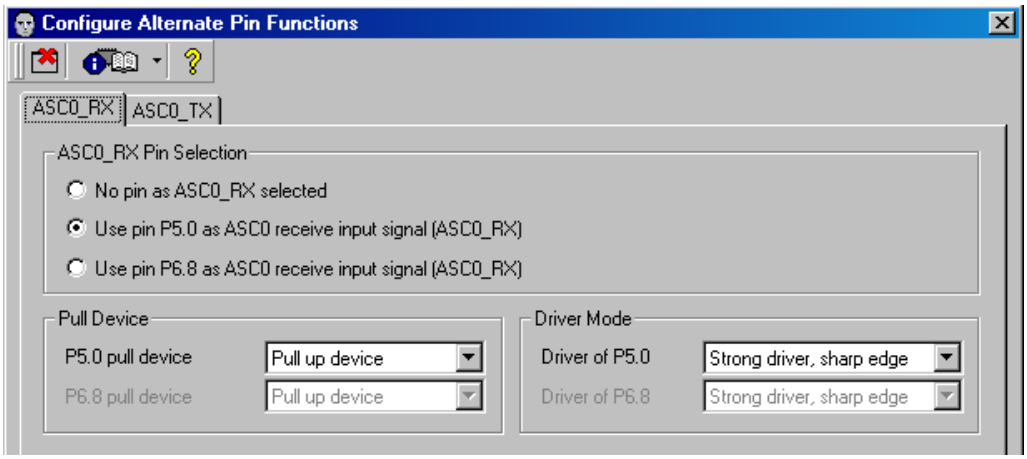
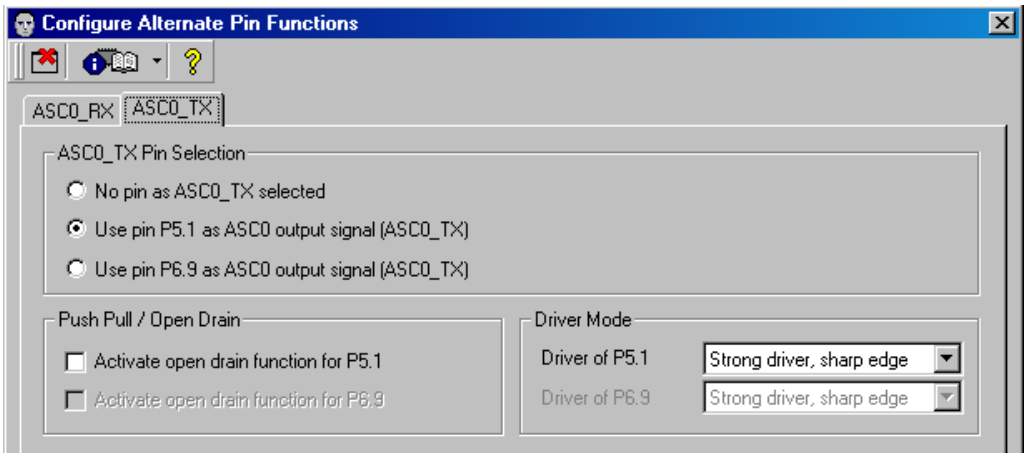
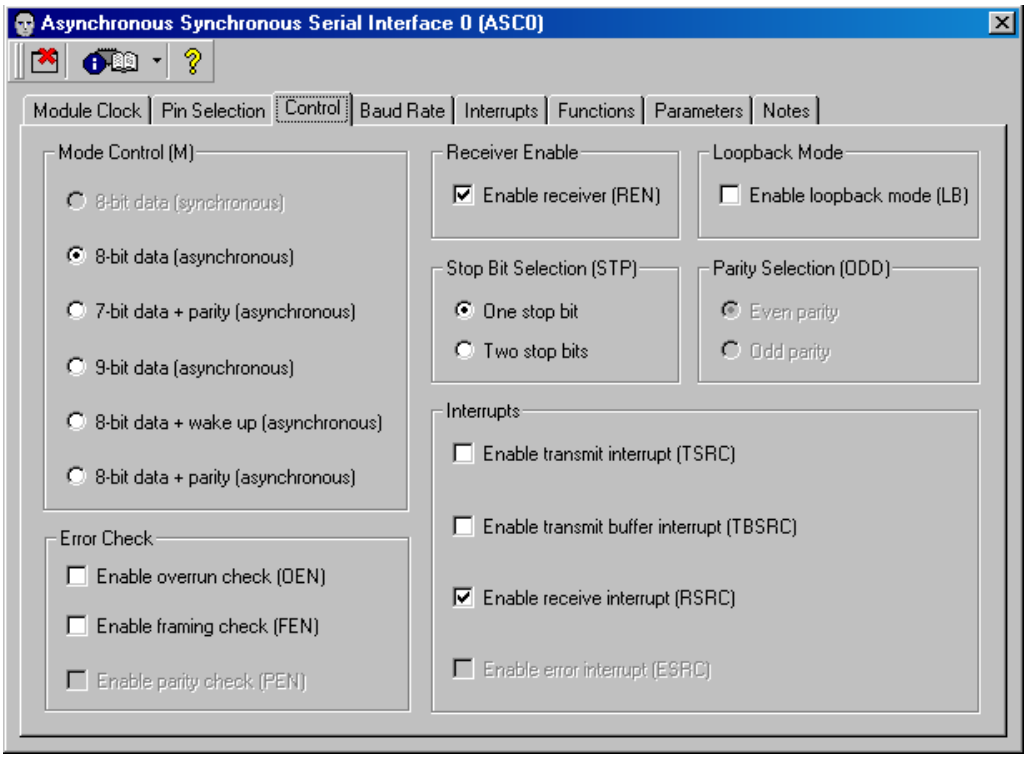



Configure Alternate Pin Functions
ASC0_RX
ASC0_TX
ASC0_TX Pin Selection
No pin as ASC0_TX selected
Use pin P5.1 as ASC0 output signal (ASC0_TX)
Use pin P6.9 as ASC0 output signal (ASC0_TX)
Push Pull / Open Drain
Activate open drain function for P5.1
Activate open drain function for P6.9
Driver Mode
Driver of P5.1
Strong driver, sharp edge
Driver of P6.9
Strong driver, sharp edge



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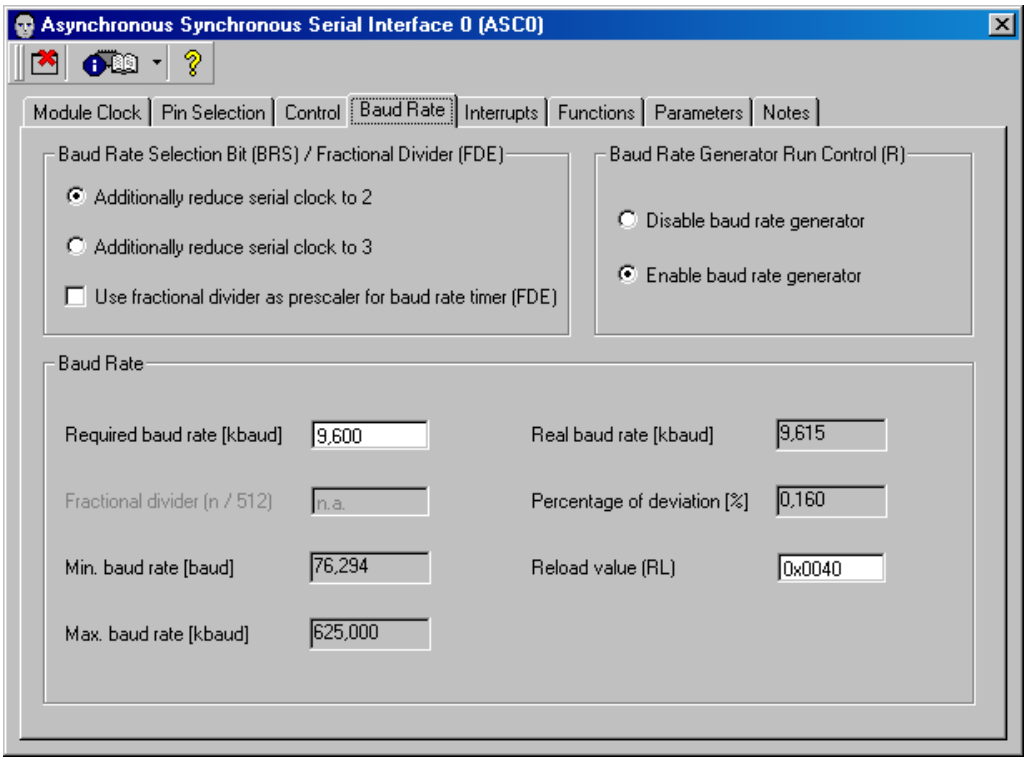

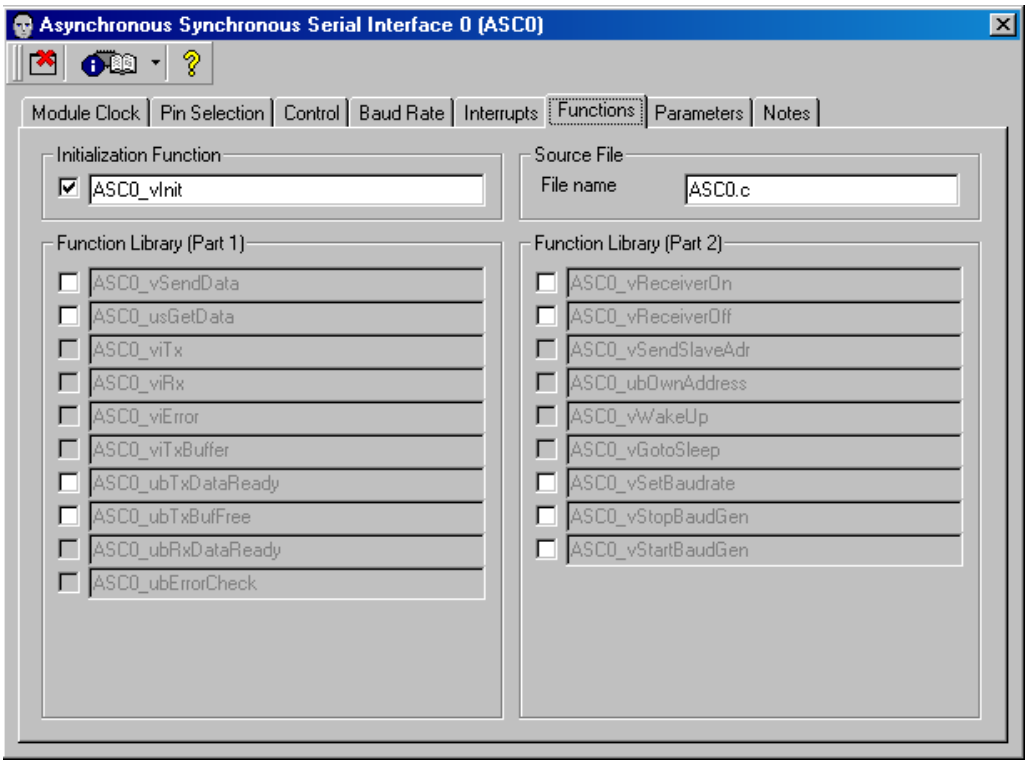

Note
DAvE will create any source file only if you selected the init function.

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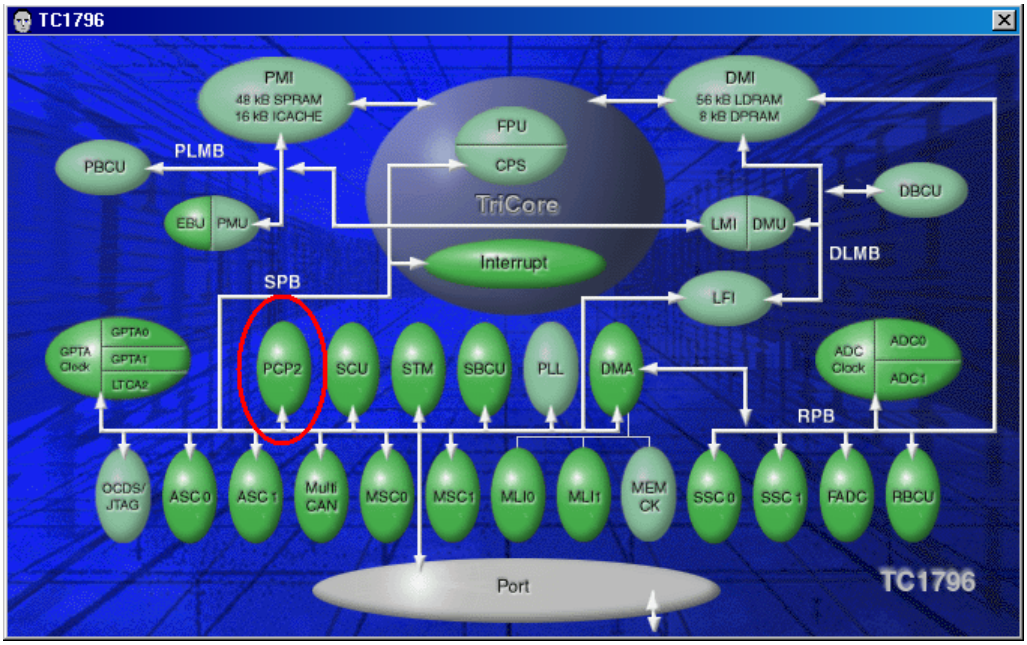
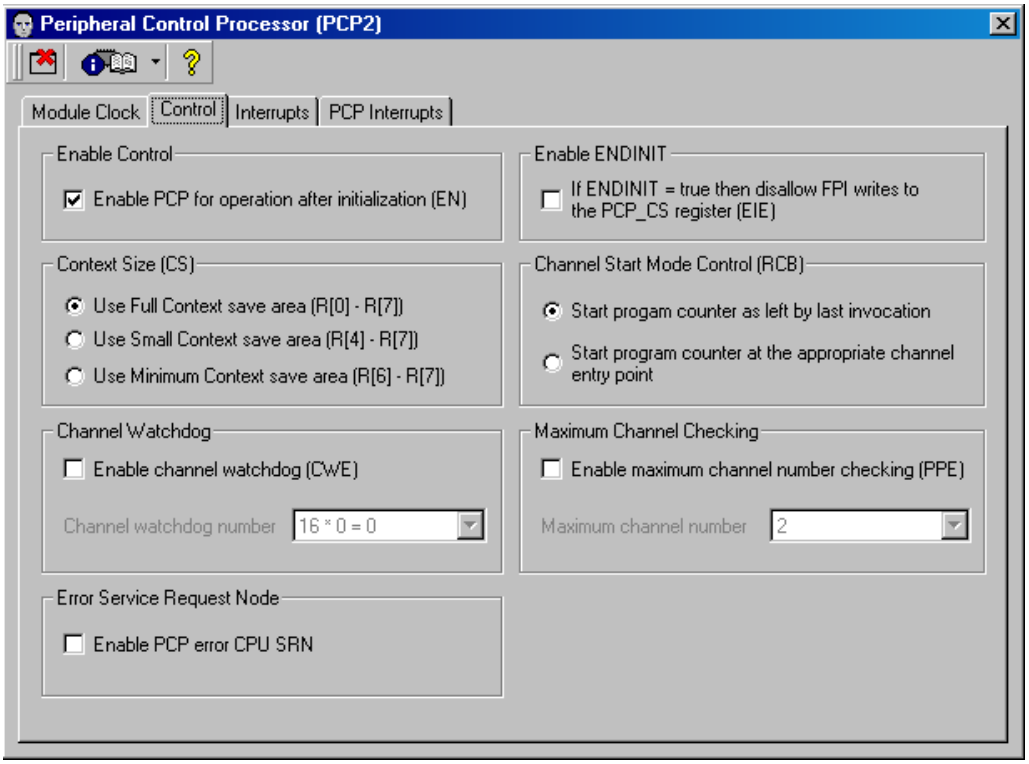
3.2.3 Configuring PCP

In this section the real PCP will be configured.

- Click on the **PCP** peripheral (red-marked in the figure below) and make the following settings:



- Activate the PCP:


Peripheral Control Processor (PCP2)
Module Clock
Control
Interrupts
PCP Interrupts
Enable Control
Enable PCP for operation after initialization (EN)
Enable ENDINIT
If ENDINIT = true then disallow FPI writes to the PCP_CS register (EIE)
Context Size (CS)
Use Full Context save area (R[0] - R[7])
Use Small Context save area (R[4] - R[7])
Use Minimum Context save area (R[6] - R[7])
Channel Start Mode Control (RCB)
Start progam counter as left by last invocation
Start program counter at the appropriate channel entry point
Channel Watchdog
Enable channel watchdog (CWE)
Channel watchdog number
16 * 0 = 0
Maximum Channel Checking
Enable maximum channel number checking (PPE)
Maximum channel number
2
Error Service Request Node
Enable PCP error CPU SRN

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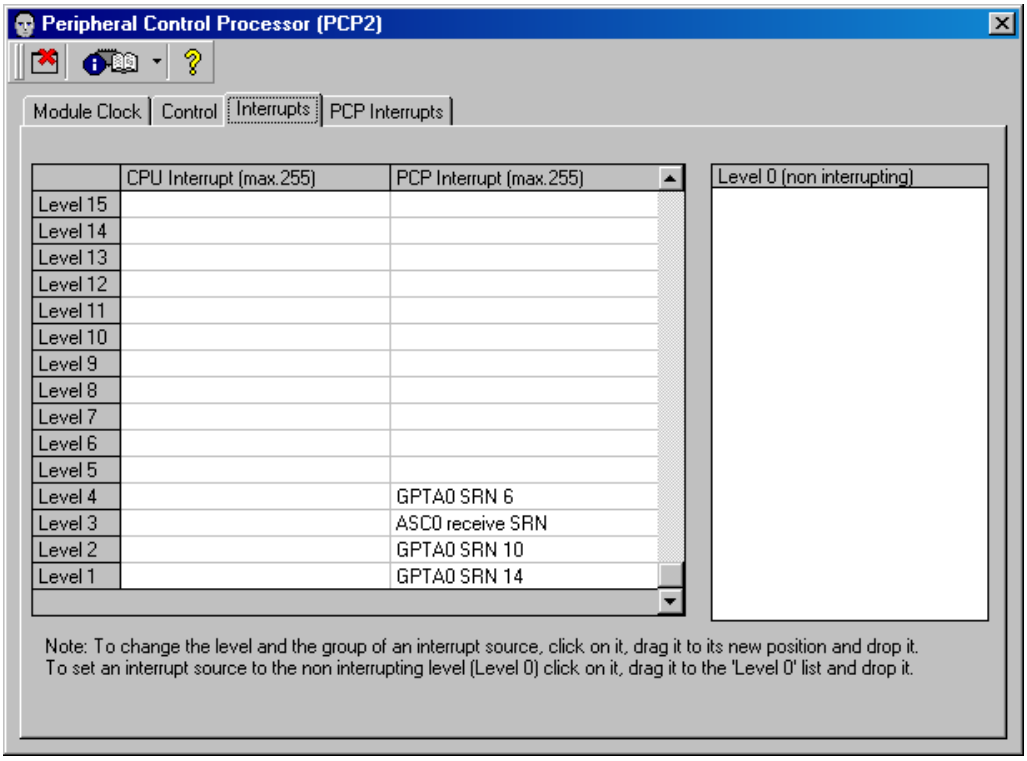
- The last step to be done by DAvE is assigning the interrupt levels:



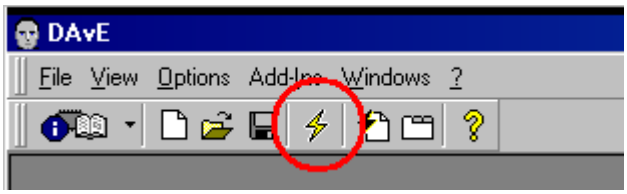
On the right, all available interrupts not being distributed are listed.

- Drag and drop them into the **CPU Interrupt** column on the left.

Note
The interrupt level in this column corresponds to the channel used. In this example it is recommended to use exactly these settings

3.2.4 Generating Code

- To generate code, click on the toolbar button (red-marked in the figure below). Select a directory you want save your code.



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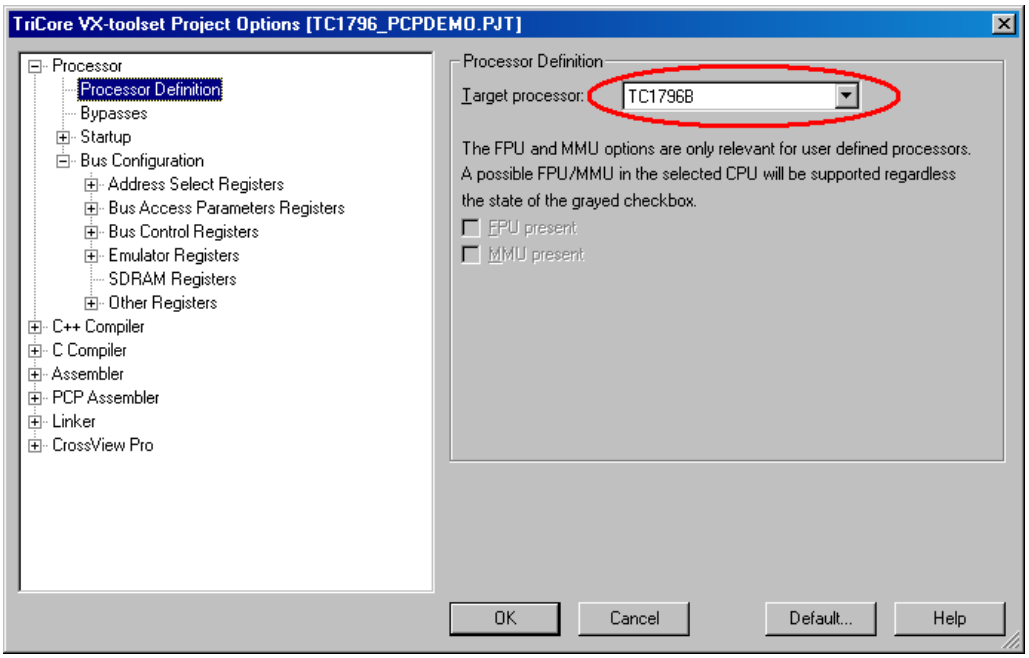
3.3 Setup Tasking Project

3.3.1 Making the Project

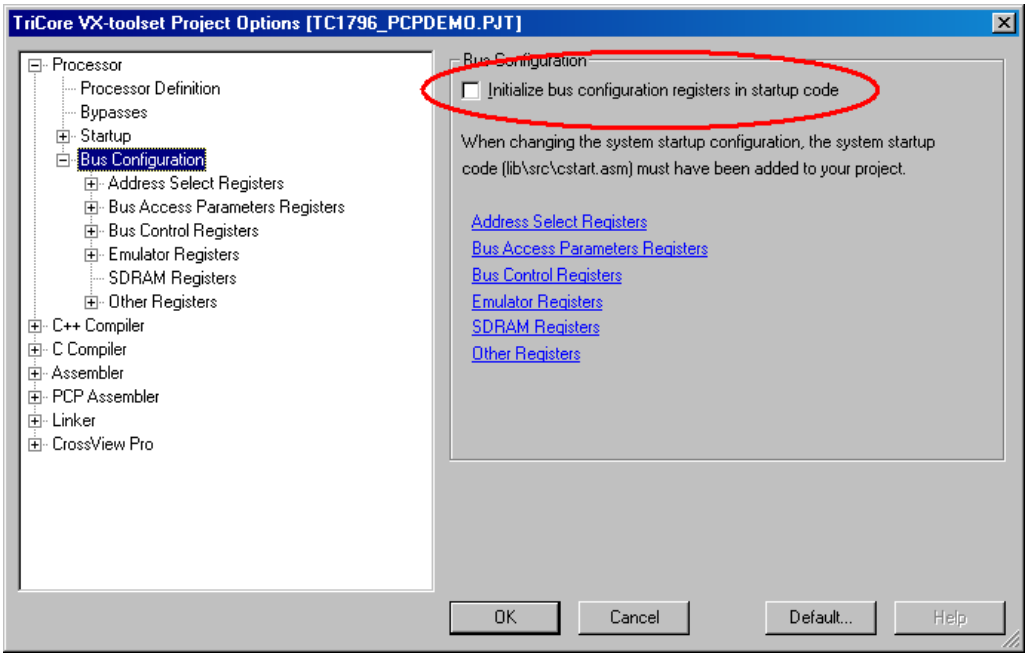
The generated files will have to be added to the Tasking project. (For information on how to generate a new Tasking Project, refer to the Manufacturer's Manual.)

In the following we give some hints different to the default settings the Tasking Toolset will use.

- Select the correct target processor.



- Disable the initialization from the bus configuration settings. These settings will be done by HiTOP.



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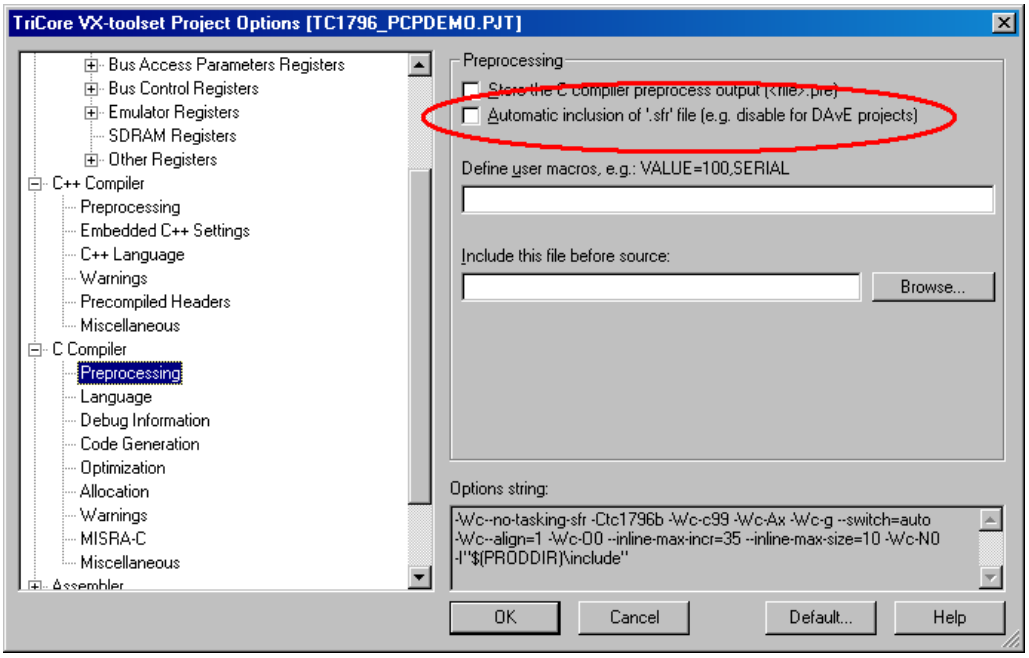
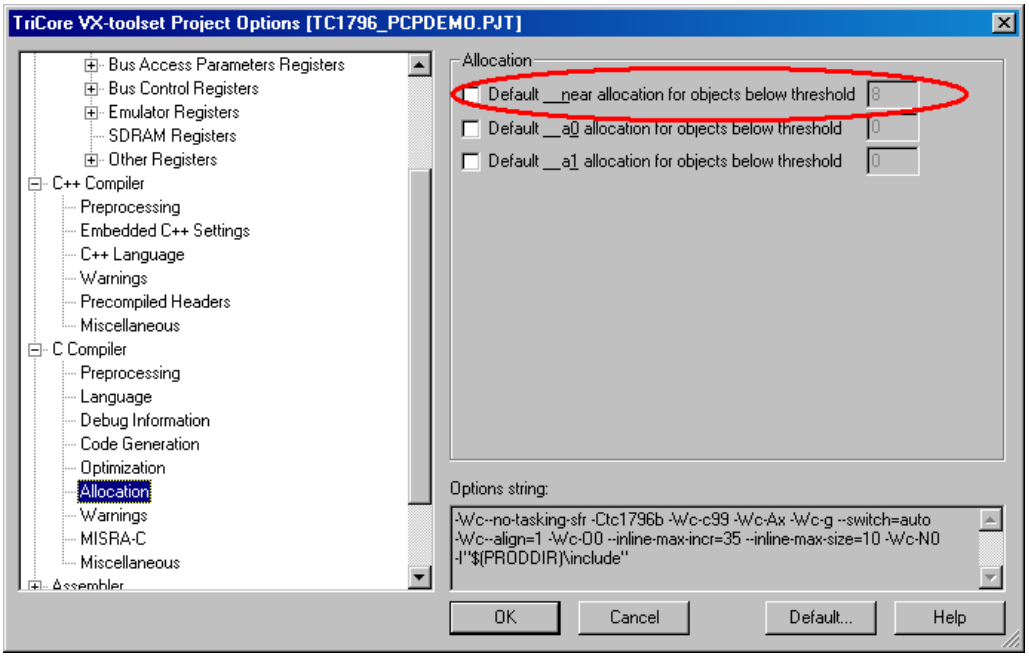
- Disable the automatic inclusion of .sfr file. These files will be generated by DAvE.



- Disable the default allocation. Otherwise you will get error messages from the Tasking compiler caused by a compiler bug.



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3.3.2 Customizing Code

The code created by DAvE, is only a frame of functions which have to be customized. To get the example running you should insert the following sections.

In the created code the following sections are embedded in the source:

```
// USER CODE BEGIN (Main,9)


// USER CODE END
```

Code inserted between these keywords, will not be changed by DAvE in the following.

The table below gives an overview on files and sections you have to change.

File	Section	Contents

main.c	MAIN_General,7	`unsigned long  lGlobalCounter;`
		`unsigned long  lGlobalCounterPCP;`
		`char        cBufPCP;`

main.c	Main,9	`while (1) ;`
main.c	Init,3	`initPCP();`

pcpInit.c *)	--	`#include "main.h"`
		`/* This function initializes the PCP unit:`
		` * - enable PCP`
		` * - channel start PC is taken from restored context`
		` * - use full context save`
		` */`
		`void initPCP(void)`
		`{`
		`  PCP_CS  = 0x00020801;  /* Enable PCP, PC from Context, Full context */`
		`  PCP ICR = 0x03000000;  /* 1 arb. cycles, 2 clocks per arbitration */`
		`}`

*) Create a new file.

The real PCP (pcpWork.pcp) program will be delivered with the example project (see also the **Appendix** on p. 32). You have to add it to the tasking project.

You may now generate the executable using the Tasking Compiler's **Make** button. This generated executable can be loaded to the target as described on p. 7ff.

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Appendix

```
;*****************************************************************************
;**                                                                          *
;**  FILE        :  pcpWork.pcp                                              *
;**                                                                          *
;**  DESCRIPTION :  PCP Example                                              *
;**                                                                          *
;*****************************************************************************/
;
            ;Definition of symblols
            .extern lGlobalCounterPCP
            .extern cBufPCP

            ASC0_TBUF_addr .equ 0xf0000a20        ;address of register ASC0_TBUF
            ASC0_RBUF_addr .equ 0xf0000a24        ;address of register ASC0_RBUF

;-----------------------------------------------;
; Note:
; A special section name '.pcptext' is used to
; direct the linker/locator to locate this
; section in pcp code. The CODE and INIT
; attributes are used to force this section to
; be copied at the start-up of the program to
; 'pcode' memory.
;-----------------------------------------------;

            .sdecl ".pcptext", CODE, INIT
            .sect  ".pcptext"

;----------------------------------------
; Channel 1, toggle LED P1.15
;----------------------------------------
channel_1:
nop
            ldl.iu r1, @hi(P1_IOCR12)             ; Initialize port P1:
            ldl.il r1, @lo(P1_IOCR12)             ; port control register 12
            set.f [r1], 0xf, size=16              ; Set pin P1.15 to Output
            clr.f [r4], 0xf                       ; Set pin P1.15 to Low
            nop
            exit ec=0, st=0, int=0, ep=1, cc_uc   ; Exit, no interrupts, start @next PC
            nop
led on:                                           ; Swith LED on
            clr.f [r4], 0xf                       ; Clear P1.15
            nop
            exit ec=0, st=0, int=0, ep=1, cc_uc   ; Exit, no interrupt, start @ next PC
            nop
led off:                                          ; Switch LED off
            set.f [r4], 0xf                       ; Set P1.15
            nop
            exit ec=0, st=0, int=0, ep=1, cc uc   ; Exit, no interrupt, start @ next PC
            nop
            jl led_on                             ; Loop

;----------------------------------------
; Channel 2, toggle LED P4.7
;----------------------------------------
channel_2:
nop
            ldl.iu r1, @hi(P4_IOCR12)             ; Initialize port P4:
            dl.il r1, @lo(P4_IOCR12)              ; port control register 12
            et.f [r1], 0x7, size=16               ; Set pin P4.7 to Output
            lr.f [r4], 0x7                        ; Set pin P4.7 to Low
            op
            xit ec=0, st=0, int=0, ep=1, cc_uc    ; Exit, no interrupts, start @next PC
            nop
led2 on:                                          ; Swith LED on
            nop
            clr.f [r4], 0x7                       ; Clear P4.7
```

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```
            nop
            exit ec=0, st=0, int=0, ep=1, cc_uc    ; Exit, no interrupt, start @ next PC
led2 off:                                          ; Switch LED off
            nop
            set.f [r4], 0x7                        ; Set P4.7
            nop
            exit ec=0, st=0, int=0, ep=1, cc_uc    ; Exit, no interrupt, start @ next PC
            nop
            jl led2 on                             ; Loop

;-----------------------------------------
; Channel 3, local echo on ASC0, transfer
;            value to R3 -> global variable
;-----------------------------------------
channel 3:
            LD.F R1, [R4], SIZE=32                 ; R1 = ASC0 Receive Buffer
            nop
            ST.F R1, [R5], SIZE=32                 ; ASC0 Transmit Buffer = R1
            nop
            ST.F R1, [R3], SIZE=32                 ; ASC0 Transmit Buffer -> R3 -> cBufPCP
            nop
            EXIT EC=0, ST=0, INT=0, EP=1, cc UC    ;exit, no interrupt, channel start @ next PC
            nop
            jl channel 3

;-----------------------------------------
; Channel 4, increases R5 -> global variable
;-----------------------------------------
channel 4:
            LD.i R1, 0x1
            nop
            ADD.F R1, [R5], SIZE=32
            nop
            ST.F R1, [R5], SIZE=32
            nop
            EXIT EC=0, ST=0, INT=0, EP=1, cc UC    ;exit, no interrupt, channel start @ next PC
            nop
            jl channel_4

;-----------------------------------------------;
; Note:
; A special section name '.pcpdata' is used to
; direct the linker/locator to locate this
; section in pcp data memory (pram). This
; section is initialized at start-up time.
;-----------------------------------------------;

            .sdecl ".pcpdata", DATA
            .sect  ".pcpdata"

ch0:
            .word 0x0                              ; R7
            .word 0x0                              ; R6
            .word 0x0                              ; R5
            .word 0x0                              ; R4
            .word 0x0                              ; R3
            .word 0x0                              ; R2
            .word 0x0                              ; R1
            .word 0x0                              ; R0

ch1:
            .word (channel_1 << 16) | 0x0140       ; R7 channel enable set, DPTR=0
            .word 0x00010000                       ; R6 CPU Interrupt Configuration
            .word 0x0                              ; R5
            .word P1 OUT                           ; R4 P1 Output Register
            .word 0x0                              ; R3
            .word 0x0                              ; R2
            .word 0x0                              ; R1
            .word 0x0                              ; R0
```

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```
ch2:
            .word (channel_2 << 16) | 0x0140      ; R7 channel enable set, DPTR=0
            .word 0x00010000                      ; R6 CPU Interrupt Configuration
            .word 0x0                             ; R5
            .word P4 OUT                          ; R4, P4 Output Register
            .word 0x0                             ; R3
            .word 0x0                             ; R2
            .word 0x0                             ; R1
            .word 0x0                             ; R0

ch3:
            .word (channel 3 << 16) | 0x0140      ; R7 channel enable set, DPTR=0
            .word 0x01000000                      ; R6 CPU Interrupt Configuration
            .word ASC0_TBUF_addr                  ; R5
            .word ASC0 RBUF addr                  ; R4
            .word cBufPCP                         ; R3
            .word 0x00000000                      ; R2
            .word 0x00000000                      ; R1
            .word 0x00000000                      ; R0

ch4:
            .word (channel 4 << 16) | 0x0140      ; R7 channel enable set, DPTR=0
            .word 0x01000000                      ; R6 CPU Interrupt Configuration
            .word lGlobalCounterPCP               ; R5
            .word 0x00000000                      ; R4
            .word 0x00000000                      ; R3
            .word 0x00000000                      ; R2
            .word 0x00000000                      ; R1
            .word 0x00000000                      ; R0



; Module End
```

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